SEPTEMBER 1961 3/6

AUTOMATIC DATA PROCESSING

JOURNAL OF MANAGEMENT AND INFORMATION SYSTEMS

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AUTOMATIC DATA PROCESSING

JOURNAL OF MANAGEMENT AND INFORMATION SYSTEMS VOL 3 No 9

SEPTEMBER 1961

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8 OF THE REASONS WHY

HERTFORDSHIRE COUNTY COUNCIL

have chosen to install

THE NCR National 315 ELECTRONIC ACCOUNTING and DATA PROCESSING SYSTEM

– with the unique and revolutionary Random Access Information File

1 The pace of development within the borders of Hertfordshire is, to use a cliché, phenomenal. So fast, in fact, that the efficiency of the County Council's financial administration can be maintained only by the use of the most efficient electronic methods of accounting and data processing available.

2 *With its unique* RANDOM ACCESS INFORMATION FILE, HIGH-CAPACITY INTERNAL STORAGE, VERY HIGH OUTPUT CAPABILITY & EASE-OF-PROGRAMMING, *the* N.C.R 315 *is adjudged the most economical of all systems –both in terms of capital outlay and operating cost.*

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(Just one Random Access File replaces *four* magnetic tape units!)

4 The extremely high processing speed of the N.C.R 315–plus the very high volume output of its line-printer–will eliminate all peak overloads and provide a comprehensive accounting facility capable of handling a rapidly expanding volume of work thus minimising the need for staff recruitment.

5 The 315's RANDOM ACCESS INFORMATION FILE provides up-to-the-*minute* EXPENDITURE DETAILS for Management Control, instantly and *on-demand.*

6 After an extensive study of available systems–mechanical, electro-mechanical and electronic–the N.C.R 315 was found to be the most suitable for the Council's requirements.

7 The superbly engineered, N.C.R designed, all-transistorized, solid state N.C.R 315 is built for the uttermost reliability under continuous-stress operating conditions.

8 N.C.R–long famed for the standard of its products and its service to all branches of Government, Local Authorities, Commerce, Industry, Finance and the Armed Forces–can be wholly relied upon to assure the full productivity of every N.C.R 315 system.

The British manufacturing of the central processor, associated component units and certain items of peripheral equipment is in the hands of **The Computing Division, Elliott Brothers (London) Limited**

NCR electronics

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Shot Gun Weddings

SOMETHING like a Duncan Sandys-type reorganisation is going on in the components section of the electronics industry. Early in the month it was announced that Ultra Electronics had acquired WS Electronics. Then quickly following on has come the news that Alma Components have taken over Alston Capacitors, and Royston Industries had bought Burndept Ltd. Then came a slight relief when the Solartron Group refused to sell their minority share holding to big brother Firth Cleveland who already have a controlling interest in the firm; then one after another came the shock that Cossor had recommended acceptance of the offer of the American Raythorne Company, and most startling, the news that the Plessey Company were to acquire the interests of Ericsson Ltd and ATE, except the transistor interests which Mullard is to take over.

What has induced these get-togethers? Most likely it is a desire to share know-how, and an urgent need for extra capital to finance research and development; but there are also the factors of having too many sellers in the market, and the need of the bigger concern to be able to offer a wider range of products or tackle a wider market.

Things are a little different in the computer field. First, the industry has strengthened itself against amalgamations by tie-ups with other sections of the electrical or office equipment industry and transatlantic agreements, such as that which produced the English Electric KDP 10. Also the market is expanding, with the developments in the microminiaturisation field, and the use of molecular structures in place of conventional circuitry.

However, the fruits of these developments will not be reaped for a while yet, and the bonuses in the computer field will continue to go to the firms of whatever size who produce specific products which offer a striking technical advance, and also to the firms who can offer—as of now—a marketing service and range of equipment to handle the bigger customers' problems reliably.

* * *

It is three years since the last Computer Exhibition was held, and in that time the computer has progressed from a curiosity to a commonplace. The Computer Symposium, to be held in parallel with the exhibition is very largely a record of that conversion. Most of the 26 papers presented will be devoted to case-histories, and though some people—including our correspondent who makes a preview assessment in this issue—think that this proportion is excessive, it indicates a welcome determination on the part of the organisers to drive home that the computer is a piece of office machinery and not a scientists' toy.

The Computer Exhibition should be impressive. There is a great deal of hardware still under wraps, and while there are the usual crops of cancellations and non-starters — there will be enough that is new to satisfy the most exacting computer modernist. In our October issue, which is devoted to the exhibition and symposium, we will be carrying out a firm-by-firm round-up of developments and new products from the major data processing manufacturers. There will be a progress report on how the ' blue sky ' topics of 1958, automatic programming, data processing centres, etc, have become realities. Dr Booth will round off the round-up with one of his forceful jeremiads on how the British computer industry—and the government and industry which they serve—have failed to maintain their early technical supremacy in the automation field.

In this way we hope to provide a landscape picture of the British computer scene of 1961, putting into perspective what might have been, has been, and is being currently achieved, in data processing.

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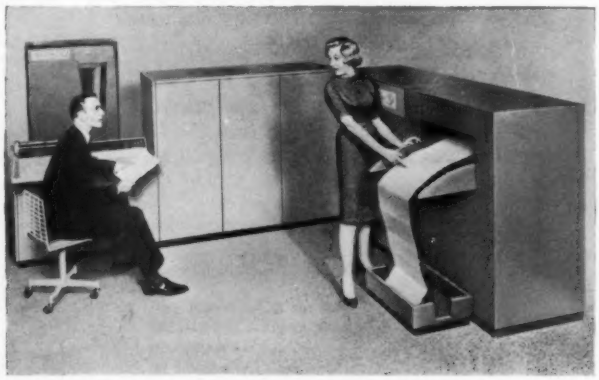

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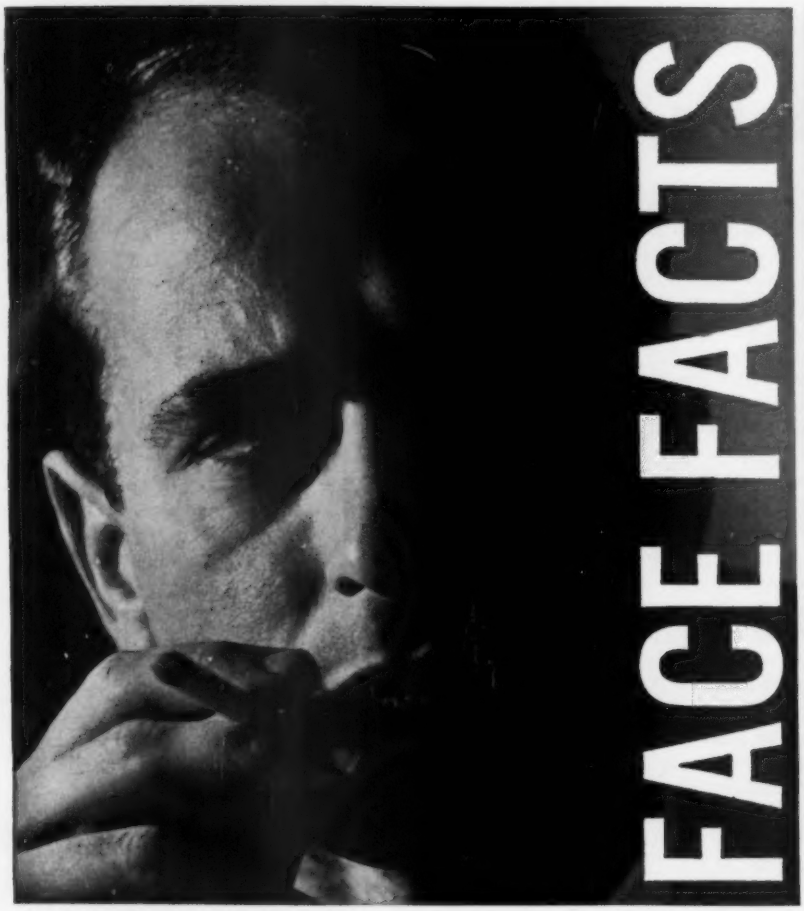

FACE FACTS

- Payroll
- Personnel statistics
- Order processing
- Production scheduling
- Production planning
- Stock control
- Purchase accounting
- Order invoicing and warehouse stock control
- Cost collection
- Costing and budgetary control
- Invoicing
- Sales ledger
- Sales statistics
- Sales forecasting
- Passenger and freight movement statistics
- Flight scheduling
- Centralised bank book-keeping for branch current accounts
- Centralised stock control and accounting for retail branches
- Retail prices index

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DATA DIGEST

Curriculum Computerised

Diploma students of mathematics at the Bristol College of Science and Technology are to be taught to handle a computer as part of their syllabus, and will then be expected to use it in their various mathematical projects. This welcome departure from academic routine is to happen when the National Elliott 803, ordered by the mathematics department, comes into service next month.

In addition to allowing students to get acquainted with all aspects of computing, the machine will be used by post-graduates for research work, and by the staff for a wide range of routine calculations and data processing tasks. It is hoped that this course will bring students more in line with industrial needs and problems; most of the mathematical staff have, in fact, done special project work for industry, including the head of the computer department, Mr Chedzoy, who has carried out considerable research on logical design work for special purpose computers. It is thought that Bristol is the first college to offer training facilities of this kind, as part of the mathematics syllabus.

Footnote: Durham University's Computing Laboratory are running two programming courses, on their Pegasus Computer, but these are not part of the diploma mathematics course.

Wilt thou take . . .

Merger of the Giants

What must be one of the biggest mergers in the electronics industry since the foundation of ICT, was put in motion when Plessey made a move to take over ATE and Ericsson Telephones. This £55 million deal will leave Plessey in control of the new combine with 62 percent of the share capital, ATE having 21 percent and Ericssons 17 percent. The total equity will be worth more than £75 million, and the group assets will amount to more than £45 million.

What will be the result of the merger? While the three boards of directors, who strongly support the move, speak of 'a more intensive and efficient use of research and productive facilities', the background to the move is clearly the overlapping of research and production in the communications field. Many separate interests are involved and it is not clear what pruning will be done.

The day following the announcement it appeared that Associated Transistors, a subsidiary jointly set up by Ericssons, ATE and English Electric, was to be taken over by Mullard at a price of £700,000. Both the Ruislip transistor factory and the tool shop at Basingstoke were to be integrated with Mullard's own transistor interests but, most significantly, the £850,000 transistor factory being built at Basingstoke, scheduled to begin production in 18 months' time, was not included in the deal.

What will happen, it must be wondered with some concern, to the newly established Bendix Ericsson, which had already done some excellent research in data transmission and control systems? Since the deal is likely to go through, despite the opposition of certain preference holders who feel hard done by, any new statements from Plessey will be watched with interest.

Step for Shoes

Timpsons order Univac

Shortly after the 'open day' at Remington Rand's new office show-room in Holborn, comes the news that the first Univac computer—a STEP tape version of the Univac 80—has been ordered by William Timpson Ltd, the big Manchester shoe chain.

Timpsons are both manufacturers—owning a factory at Kettering; distributors — importing large quantities of shoes from Italy and other overseas countries; and also retailers—owning a

◀ *Stock control in Step*

chain of some 270 shops, mostly in the Midlands and North. It is intended that the new computer will form the basis of an elaborate stock control system based on the central warehouse in Manchester. Branch allocations and imprest stocks will be maintained and updated through the computer, and sales and stock records established on a two-week cycle basis. The check on branch sales will be maintained, rather on the lines of a Kimball system, by a punched card being packed in with each pair of shoes, and returned to the warehouse, as sales are made.

The computer complex consists of a high speed reader operating at 450 cards per minute; a central processer with 3,000 words of storage; a printer operating at 600 cards per minute; a tape synchroniser, and four magnetic tape units operating at 25,000 characters per second. Full buffering facilities, as between reader, printer, and tapes, are available. Timpsons expect to take delivery of the computer in March-April 1962.

Parting Kick

Kendall castigates government, industry

In a caustic letter to *The Times*, Professor Maurice Kendall revealed the basic discontent which has motivated his move to CEIR, to which he is going as Director of Scientific Studies on 1 October. Stung by the news that the government and private industry, in the person of Mr Wolfson, had been able to find the £140,000 necessary to save the Goya painting from leaving the country, Dr Kendall remarked that his department, the Statistics Dept of LSE, had been carrying fundamental research into the basic causes of our economic crises, and means of stabilising the economy. These researches had been made possible through grants from the Ford Foundation, and when this sponsorship ceased, he had been unable to get support for continuing his researches either from the government or from private industry. The idea that money is available for a painting and not for this fundamental research seemed to him a standard of values which was in his pungent phrase 'suicidal'.

It is not known whether Dr Kendall will be able to carry out his researches under the benevolent auspices of CEIR.

Interim Statement

Bank build up to computer

The second stage of computerisation, the setting up of a data processing centre, is announced by the National Commercial Bank of Scotland. A punched card complex with an electronic calculator as its central processing unit has been set up to handle the routine record keeping of more than 20 branches in the Edinburgh area; it is anticipated that more branches and more tasks will be systematically brought into the system until, with its capacity reached, the calculator complex will be replaced by an IBM 1401, with high speed magnetic storage.

Among the tasks now being undertaken by the calculator is the handling of current account and savings bank book-keeping with the appropriate and interest calculations, and payments required for customers' standing orders. Data input is prepared as a by-product of day-to-day operations on National and Burroughs machines and transmitted to the centre as punched paper tape. Posting to customers accounts is carried out at the centre at 150 entries per minute, and interest and service charges are calculated at 100 per minute.

The branches receive a daily printed report showing the state of each customer's account first thing each morning. The layout of the form has been so designed that any account requiring attention is brought to the manager's attention immediately so that he can survey the account position of all his customers within a few minutes of arrival at the office.

Rugby's Swedish Punch

Carousel, reader, punch to be sold

A new type of random access tape memory, known as the Carousel, is to be marketed in this country by AEI Ltd, following an agreement with Facit Electronics of Sweden. This memory unit, say the makers, is designed on a totally new concept, and is radically different from previous equipments. With an access time of two seconds for any block of information the memory is able to store up to five million checked decimal digits of information, or up to three million checked alphanumeric characters. No further details have yet been released, and it is not known whether this equipment will be

compatible with the AEI 1010, or whether it will be sold as a component, or as integral part of an AEI system.

As part of the Facit-AEI agreement, two other components are to be marketed. These are a transistorised tape reader operating on the dielectric principle and able to handle five-, six-, seven- and eight-channel tape, and a high speed tape punch, of a simplified design, which can also accommodate five- to eight-channel tape. These equipments will be marketed under the agreement not only to Britain, but to all countries of the Commonwealth except Canada.

Big Six Convene

For high level liaison

Six of the biggest names in the computer industry make up the initial membership of a special electronics board established by the BEAMA Council, designed to 'provide an organisation to safeguard the interests of British manufacturers concerned with electronic engineering'.

Chairman of the board is Mr Leon Bagrit, Deputy Chairman and Managing Director of Elliott Automation, who since the war has probably done more than anyone else to widen the range of automation and automatic control equipment, including computers, available to British manufacturers. Also on the board are Mr O W Humphreys of GEC, Mr E B Banks of English Electric, Mr W S Steel of AEI, Mr Sebastian de Ferranti, and Mr Clifford Metcalfe, until recently head of EMI Electronics.

The Council say that the board will act for them on matters of broad policy and provide the necessary high level liaison with government departments. But it is a little surprising to find, on a board representing the British computer industry, no representative of the two British 'pioneers' in data processing, ICT and Leo.

BAGRIT
For industry's sounding board

Broker Breakthrough

First portfolio processing centre opened

Pipping National Cash, whose city computer centre will not be opened until mid-September, ICT have opened their City Service Bureau in Lackington Street, just off Finsbury Square. Here, in a spacious basement, a punched card complex—electronic calculator, mark sensing reproducer, and high speed tabulator—handle the production of stockbrokers' portfolio valuations. Also located in the centre is the Dividend Service Bureau, which ICT has operated, albeit in another place, since 1935.

The snag about the portfolio valuation system is that it requires the client to have his own punched card complex, consisting of punch, verifier, and interpreter, since he must do his own 'homework' in punching two card files—a client file with a card for every security held, and a company file, with a card for each security collectively held. However, ICT consider this outlay will not deter stockbrokers, most of whom have this basic equipment already.

On each client file card the broker marks in pencil a column signifying the current price of the securities. The files then go to the centre, where the cards are mark-sensed and processed. The broker will receive back the same day, or the day following, a complete valuation list, a client file used in the preparation of the valuation, and an unmarked client and company file, to be used in the next valuation.

This is the second punched card complex of this kind that is being used in the share transactions, since the Stock Exchange themselves are producing lists of the 160 most dealt in stocks for brokers and jobbers, and also lists of takers and deliverers for the end of the account operation on this type of equipment. As a slightly ironic footnote on the relative progress of automation in the Market, it is interesting to note that the New York Stock Exchange have just installed a combined IBM 650-1401 system.

OR in Management

Consultant to be visiting professor

Manchester University, who are expanding the Industrial Administration department of their Science and Technology College, have invited Mr Ronald Beresford Dew, Assistant Managing Director of Production Engineering, to be visiting professor in Industrial Administration.

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Very high operating speed

Simple and economic programming

Translators from standard pseudocodes

Full range of peripheral devices

Autonomous operation of peripheral transfers

Time sharing among up to four programs

Wide range of arithmetic operations

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Professor Dew's role is seen in bridging the gap between academic studies and industrial practice, and it is hoped that a series of seminars will be set up, covering industrial morale and motivation, managerial control over cost, quality, sales inventory etc, in which academic and industrial staffs may meet and exchange ideas.

News in Brief

Permission has just been granted by the Dean of Court Guild for the National Coal Board to install a £200,000 computer centre at Bankhead Crossway, Edinburgh. The Scottish Division of the NCB, who are responsible for the installation, hope to have the centre operative by Autumn 1962.

The IBM Paris data centre, the Institut Europeen de Calcul Scientifique, has been expanded in capacity by the addition of a combined IBM 7090-1401 system.

In the July issue we referred to the Ice input checking equipment which is in use in Barclays Bank computer department. We would like to make it clear that while the idea was conceived and the prototype made by Mr Davy Thomas of Barclay's, the production model was designed and manufactured by Recording Design Ltd, who are now marketing this as a standard product.

Computing Car Design

For some time now the Research Department of the Ford Motor Company, based on Birmingham, have been using the English Electric's computer bureau at Kidsgrove, Stoke-on-Trent, to carry out calculations and simulation work in respect of car design. The Kidsgrove bureau is equipped with two Deuce computers, and it is on these machines that problems relating to expected performance, safety, economy, and passenger comfort are being worked out. The use of computer techniques at the design stage has resulted in speeding up the whole process of design, from drawing board to prototype, and many other advantages have accrued, in the production of optimum design solutions, comparison of various systems, etc.

A typical problem put on the Deuce was that of evaluating the different types of suspension. The previous method of assessing suspension characteristics was by building and testing precision-engineered models in various simulated conditions. A computer program was written, in co-operation with Kidsgrove, which evaluated the steering characteristics induced by bends, cambers and variations in road surfaces and the effects of braking and acceleration on the stability of the car and the various criteria to be worked out included tyre wear, the degree of under-steering experienced in turning, and other factors relating to the riding comfort of the passengers. The analysis required a considerable amount of detail, establishing for example, the best position for bolts, in order to reduce wear on the joints to the minimum. The performance analysis program produced the optimum solutions required, and reduced the amount of practical testing required.

As a part of this analysis vibration suspension characteristics on certain road surfaces were assessed and a complete analysis was carried out of rigid rear axle and leaf spring suspensions, examining and contrasting vehicles equipped with independent and conventional rear suspension systems. It was found that these calculations were able to be handled by programs from the Kidsgrove program library—the suspension analysis was done by a program written originally for stressing building frameworks. In this way no special program had to be written, one of the savings offered by using a computer bureau, a library of programs and sub-routine being available to customers.

Calculations relating to the assessment of drag, as it affects car performance have also been carried out at Kidsgrove. An assessment had to be made of the relative importance of rolling assistance and wind resistance, relating deceleration to retarding force. This was done by using standard matrix programs to reduce the large quantity of experimental data involved.

In the field of engine design the Deuce has calculated the temperature distribution in pistons and carried out a general vibration analysis of rotating parts. It has evaluated the bearing and crank shaft stresses during the firing cycle. It has also been used to evaluate and relate past performance and theoretical work on engine design to predict the thermal efficiency of new designs.

The next problem which the bureau is to tackle, and on which work is already well advanced, is the automation of standard gear design procedures. This entails the working out of correct settings for gear cutting machinery as well as gear dimensions, and stress analyses of gear pinions, a complex sequence of calculations which require careful and detailed programming on the Deuce.

The Kidsgrove bureau is shortly to be supplemented by a large KDP 10 data processing installation, and it is anticipated that the work for the Ford Research Dept will eventually be transferred to this faster and more up-to-date machine. Meanwhile, it is significant that Fords, who have two large scale computers of their own, should hire out time at the Kidsgrove bureau, a measure of the economy and the service which the bureau offers, even to computer owners.

Jackie invites you . . .

to see for yourself **on the Paragon Stand at the B.E.E.**

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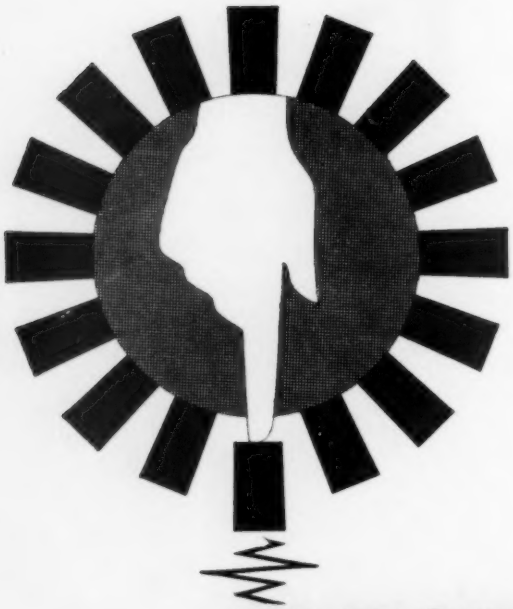

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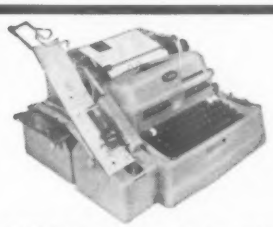
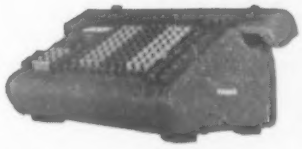


FLEXOWRITER automatic writing machine producing punched tape as a by-product of typing: the basis of IDP.



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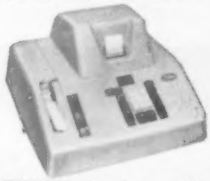

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DTV

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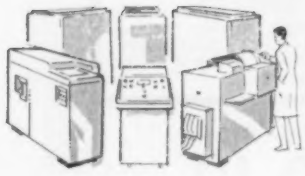

The Gamma 3 Computer *(left)* is an electronic calculator with variable drum storage of up to 200,000 decimal digits and a basic on-line printing speed of 150 lines per minute.

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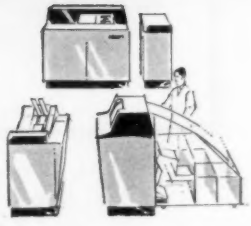

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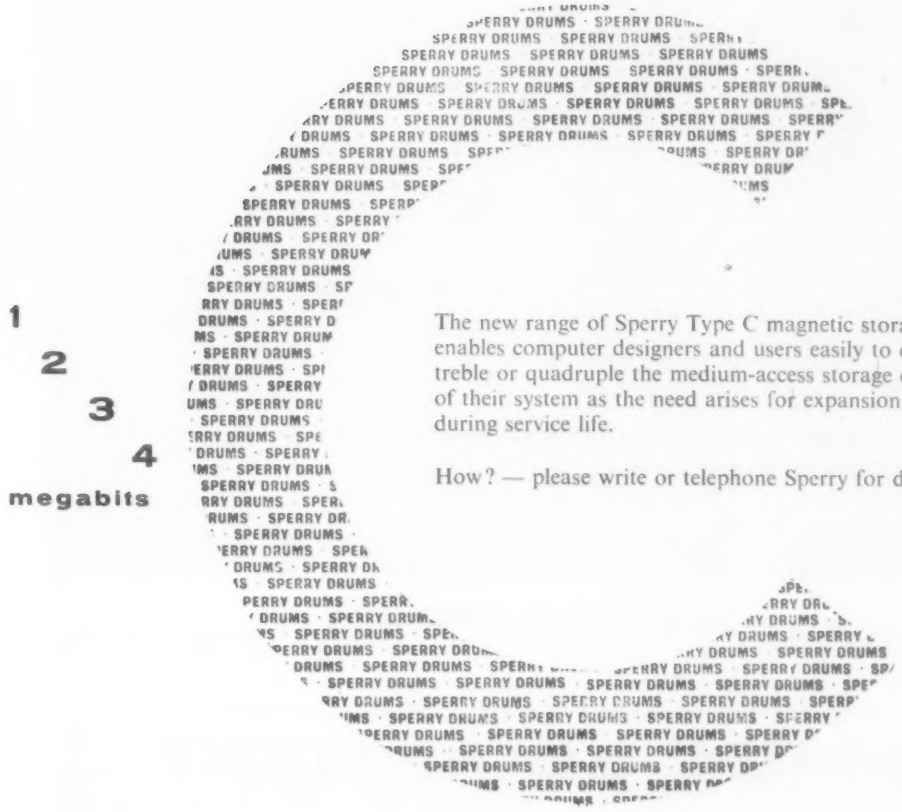

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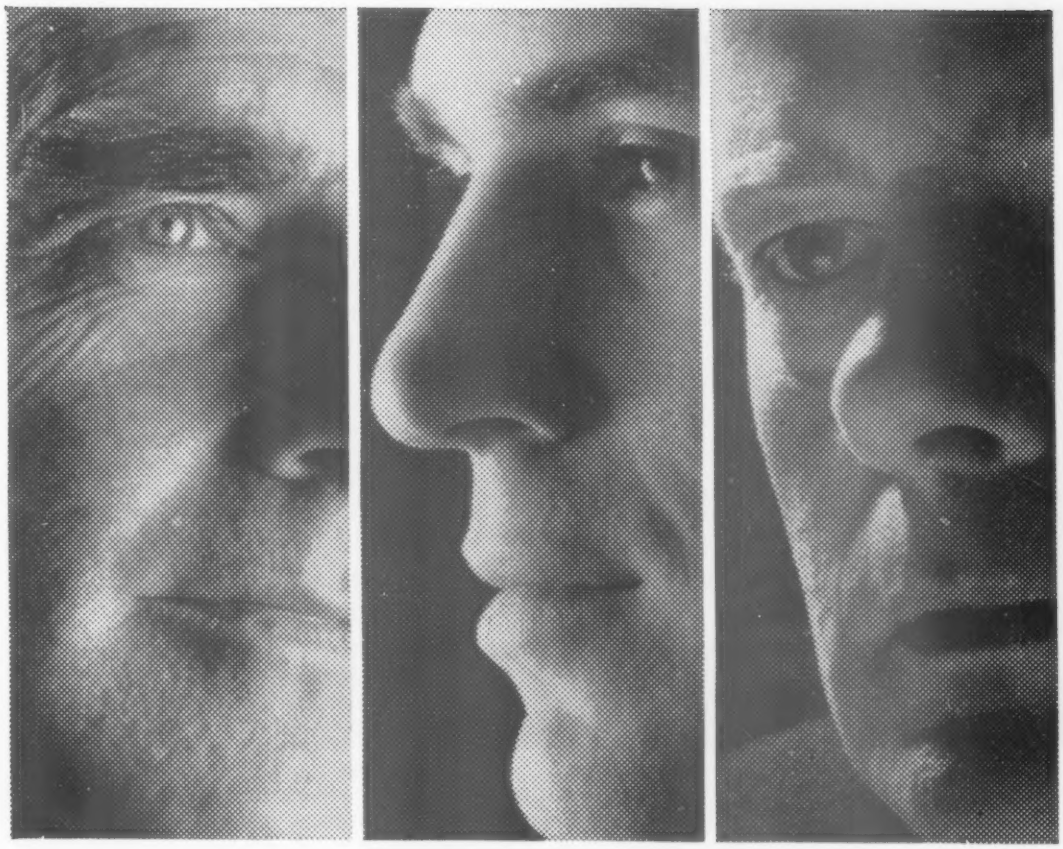

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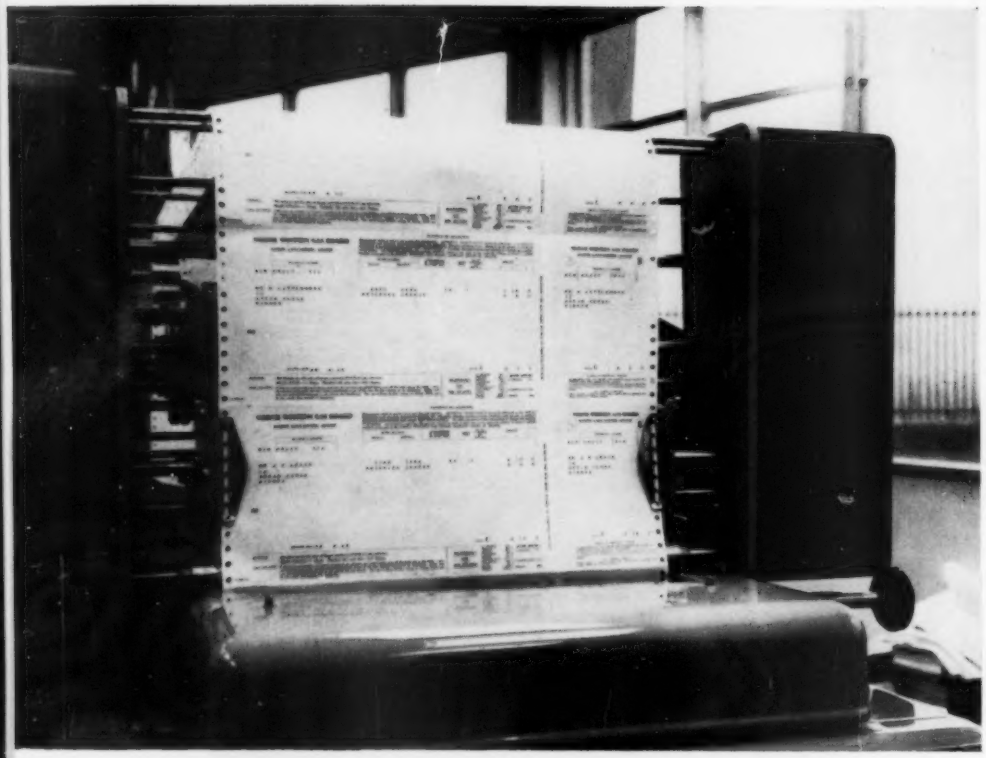

Bills for a million

Mr North Western Therm burns to serve over a million customers, aims to get paid for doing it and figures a computer will be a cheaper way of preparing their bills

THOUSANDS of householders in Lancashire and Cheshire are now involved—almost without knowing it—in a large data processing project. An electronic computer produces their quarterly gas bills, records their payments, jogs their memories when they are slow in paying, and notes any changes in address or equipment which affects their accounts. Details of these transactions are not kept in printed form but on reels of magnetic film.

When the project is complete, no fewer than 1,200,000 accounts will be dealt with in this way.

The new system is being developed by the North Western Gas Board which, under the vigorous chairmanship of Douglas Pole Welman, has built up a considerable reputation for administrative efficiency and progressive management. Although it is only a short time since first 'electronic' bill was issued, the planning of the project goes back to 1956. In a sense, it goes back even further—to the day in 1949 when the newly-constituted board inherited the responsibilities and working methods of 103 separate gas undertakings, scattered over the whole of Lancashire and Cheshire and varying enormously in efficiency and profitability.

Before very long the Board had begun to redeploy its resources and build up uniform standards of service. Uneconomic gas works were closed; others were enlarged and modernised. For administrative purposes the undertakings were assembled into regional groups, of which there are now eight.

Meanwhile, the Board had to tackle the very urgent task of setting up accounting sections at group level. No use was made of creditors' or debtors' ledgers; from the start, the customer accounting systems were based on the simultaneous preparation of a debtor's stub with the invoice, so that full advantage could be taken of negative posting. Most of the work was done on keyboard accounting machines, although some use was made of punched cards.

In 1956 the Board decided to review the systems which they had set up seven years previously. Because of the heavy volume of paperwork it seemed that there was a strong case for introducing electronic methods of data processing and data storage.

After careful feasibility studies, the Board chose a National-Elliott 405 computer system. It is on this machine that the current work is done.

The initial part of the operation, involving two of the eight regional groups, confirmed the practicability of centralised billing, and a second 405 system is now being installed. With this double installation, it will be possible to take over the whole of the accounting work for the 1,200,000 quarterly credit customers, together with stores control and general accounting.

To deal with the output of two computers, the Board has also installed a high-speed printer which, in conjunction with a magnetic film converter, produces bills and other documents at the rate of over 600 lines per minute.

LONG-TERM PLANNING

Because of the volume of work, the whole operation had to be planned with exceptional care. It was not simply a case of installing a computer and writing programs for it, but of making sure that the most accurate information was prepared and delivered to the computing centre in the most economical way. Theoretically 'perfect' systems were not required; the ultimate test was whether, with a centralised electronic system, the work could be done more cheaply than with the scattered bookkeeping systems then in force.

In the Board's long-term development programme, speed is regarded as less important than reliability. The billing and accounting work is being transferred to the computing system in self-contained batches, based on the regional breakdown. So far two groups—representing about 150,000 accounts—have been 'taken over' in this way, and much larger operations will start when the new machine is brought into service.

Take-overs are geared to the reading of meters—as each meter is read the customer's record disappears from his local office and re-appears at the computer centre. Since meter-reading and billing are done continuously on a quarterly cycle, it takes three months to absorb the accounts of one group. This 'winding down' in the group accounts department is preceded by at least three months of active preparation.

In developing the long-term programme, much consideration was given to the question of staff requirements. *The original estimates (now being confirmed by operational experience) indicated that that there would ultimately be a saving of several hundred clerks.* Although it was reasonable to assume that normal staff wastage would prevent redundancy, there was still the problem of making sure that the clerical labour force, scattered over two counties, was re-deployed efficiently without causing hardship in individual cases.

For this reason the Board began its computer planning by laying down a firm recruiting policy: wherever possible, only temporary staff was to be engaged for clerical work of any kind. Similarly, a careful check was kept on proposals to enlarge local offices to meet the pressure of work brought about by the steady growth of the Board's operations. It might be claimed therefore that the computer was responsible for economies—at the expense of some temporary inconvenience—even before the installation date!

Accommodation was already scarce at Bridgwater House, the Board's headquarters in Man-

chester, and there was certainly no room for a central billing department. But this situation could be turned to advantage.

The Board decided to erect a new office block on the site of a closed production unit at Altrincham, Cheshire. This gave its architects a chance to design premises which exactly met the requirements of the computer system, and thus translated into bricks and concrete the compact lines of the flow chart which the O and M team was then drawing up.

The new building is on one level and covers an area of 16,000 square feet. Its plan resembles a table-tennis bat with a hole in the centre. The ' handle ' contains the administrative office and services. At the point where the ' handle ' joins the ' bat ', there is a combined reception and despatch office. Beyond this, the operating sections are arranged in a complete circle, following the natural flow of work: control (where clerks check the incoming data), punching, computing, printing, form cutting and envelope stuffing, and finally despatch.

This is one of the few office blocks which enables visitors to follow the processing sequence from start to finish in one clockwise circuit. Tours of inspection are in fact facilitated by a continuous 6ft-wide gangway, established for the purpose of moving work from one section to another on specially-designed trolleys.

On the inside wall of the circular block there are offices for supervisors, programmers and other specialists. Each of these is alongside the operating section to which it is most closely affiliated.

ORGANISING THE WORK

The basic features of the clerical work the Board have to do are as follows: the customer's quarterly consumption of gas is calculated from the readings on his meter card and extended at the appropriate rate per unit. This value is then transferred to a bill, together with any other charges (for example, hire-purchase payments on equipment supplied by the Board). After a certain time, the consumer is sent a reminder notice if his account is in arrears.

Under the old system this work involved a mixture of manual and mechanical operations. The computer has co-ordinated these into one largely automatic sequence, yet it has done so without making fundamental changes in the procedures or their end-products.

Under the new system, the ledger is kept on the reels of magnetic film which make up the 405's large-volume store. Only two kinds of document—a meter reading card and a copy of the bill—are produced for record purposes; and both of these are immediately passed to the consumer's local office.

Although meter readings and payments make up the bulk of the incoming data, there are in fact 22 different types of data, and therefore computer input, to contend with. They cover such things as the installation of new meters, new hire purchase commitments, change of address, refunds, the re-introduction of arrears (where cheques presented in payment are not honoured), and suppressed noticing (where charges are disputed by the consumer and become the subject of correspondence).

In all cases, the O and M team has designed special forms to simplify the task of assembling the data for computer processing.

Since meter-reading and billing are continuous operations, every account is processed on specific days of a three-month cycle. During this period of time, each section of the ' ledger ' undergoes six computer ' passes '. These are:

Pass 1. Entering meter readings and billing.

Pass 2. Credit posting.

Pass 3. Credit posting.

Pass 4. Producing reminder notices.

Pass 5. Producing arrears collectors' lists.

Pass 6. Revising the accounts in readiness for the next accounting period.

Each quarter of the year is divided into 60 working days. Over these is spread the continuous stream of data from different groups. Following a carefully-devised schedule, the data is then used to update the magnetic films which provide what the Board describes as a ' moving carpet ' for each day of the accounting period.

Three magnetic files are normally used during each computer ' pass '. Information read from the *old record film* is up-dated and completely re-written on a *new record film*. Simultaneously, the computer accumulates certain items on a *billing film*, from which bills or reminder notices are subsequently produced during an off-line printing operation.

The computer has two paper tape output punches, which are used to produce accounting summaries and reports on exceptional items which call for special attention.

To simplify the preparation and processing of data, each consumer is identified by a ' descriptive ' account number. This consists of:

Group (one digit)
District within the group (two digits)
Street (three digits)
House number (three digits)
Processing day within the cycle (two digits)

Customer records are stored on magnetic film in account number order. Therefore the input data has to be sorted into this sequence before it is fed to the computer. To simplify this operation, the account number appears on every input document. In the case of bills (and the receipt stubs which provide input for credit posting) it is automatically

The punch room, where the meter reading books are converted to paper tape, the tapes being then assembled in correct sequence and passed to the computer section.

inserted by the computer before the document is produced. In other cases it is inserted manually. Every local office has been issued with a specially-compiled street index and a copy of the processing schedules, and is thus able to ' reconstruct ' an account number, where necessary, from its own records.

Notational numbers are used for consumers living in un-numbered houses. Similarly, the use of suffixes enables the system to be extended to new housing estates and old houses which have been divided into flats.

METER BOOK REDESIGNED

For the billing routine, the input data is extracted from the original record of the meter reading. This, in itself, eliminates the unnecessary transcription of data from one record to another, and also minimises the risk of transcription errors. Moreover, the O and M team has redesigned meter reading books in a form which greatly simplifies the work of punching data into paper tape.

Each book contains 200 sheets, on each of which are recorded the readings of one meter. Before the books were issued, the sheets were pre-printed with the quarterly readings for the previous year, thus providing a basis for estimating the current consumption of gas if the reader is unable to obtain access to the meter. Details of equipment and hire-purchase contracts are recorded on the backs of the sheets. The books have been designed for a life of three years, and it is intended that the next set will be produced automatically by the computer from the magnetic film records.

Meters are read to a definite timetable which corresponds, of course, to the computer processing schedules. Each book represents about two day's work for the meter reader. When this is done, the book is sent to the computer centre at Altrincham in a specially constructed fibre case.

At the beginning of each book there is a ' leading sheet ' which contains the code numbers of the group and district. Similarly, the street code number is given only in the leading sheet for each street covered by the book. This arrangement reduces the punching work to an absolute minimum. After the first account in each section of the book has been dealt with, the operator has only to punch the house number and meter reading for each succeeding account. (Where it is necessary to distinguish between different consumers at the same address, the first three letters of the consumers

name are also punched.) In the opinion of the Board, this method of preparing computer input provides maximum economy in time, labour and materials (paper tape is much cheaper than punched card blanks). Because the original documents are pre-arranged in serial order, the input data is automatically 'matched' to the records in the magnetic ledger. Indeed, the computer is programmed to throw out items which do not conform in this respect; details are printed on an interrogation sheet, so that a manual check can be made.

Before the input data is punched, the meter reading books are inspected by the control clerks. No pre-listing is done; but after the electronic processing has taken place the same clerks list and balance control accounts—the Board insist that everything produced by the computer should be balanced by standard accountancy methods.

After punching, the individual tapes are assembled into the correct sequence and passed to the computing section. During the billing run, the machine automatically carries forward to the next accounting period any charge of less than two shillings; to produce bills in such cases, and thus set in motion the collection procedure, would be uneconomic. The computing run, as previously explained, not only updates the ledger records but also produces a separate billing film, from which bills are prepared automatically in the high-speed printing section.

The printer originally installed by the Board had a top speed of 150 lines per minute, but the National printer now coming into use works at four times this rate and thus raises the output of bills from 800 per hour to nearly 4,000 per hour. The new machine also has the advantage of incorporating a number of checks on the reliability of the printing. With the original printer there were no facilities of this kind, and consequently the Board made arrangements for the control clerks to inspect every 100th bill. (Another precaution, still in force, is that if the total charge calculated by the computer exceeds £15, the serial number of the bill is punched into tape so that a manual check can be applied.)

As the printer works at high speed, it has been possible to simplify the operation and reduce stationery costs by dispensing with carbon copies. Instead, the machine prints a complete set of forms on the same continuous sheet—the office copy on the lefthand side and the receipt stub on the right.

As the Board appreciates that much of the advantage of high printing speeds would be lost if there were delays and inefficiency in dealing with the documents afterwards, fast automatic machines are used in the form cutting and trimming section. First, the continuous forms produced by the printer are separated on a decollator and trimmer working at the rate of 4,000 bills per hour. Then the individual forms are fed into a Swiss-made machine which folds them and stuffs them into window envelopes at the rate of 2,800 per hour. These speeds are very closely matched to the output of the printer; consequently there is no danger of bottlenecks during the final stages of the billing procedure.

At the appropriate time reminder notices (required by about one out of every five consumers) are prepared in much the same way. Once again, uneconomic collection expense is avoided by getting the computer to carry forward any sum below ten shillings.

RECORDING PAYMENTS

For payments (which, of course, are received in random order) there is a somewhat different input system. The original document is the receipt stub produced by the high-speed printer during the billing operation. This is 'certified' at the consumer's local office when the payment is made by post or over the counter.

The larger branches are already equipped with receipting machines and eventually the smaller branches will have these too. The main advantage of using receipting machines is that as the bill is certified, an identical record is automatically printed on an audit strip. These strips, totalled mechanically, facilitate the work of the group accounts officers, through which the receipt stubs are routed to the computer centre.

In the early stages of the project, the payment data was punched into paper tape. Subsequently the tape was sorted into serial order by the computer and transferred to a 'suspense' film, which was used to update the ledgers at the end of each 10-day credit posting cycle.

Now that full-scale operations are beginning, the Board has decided to use punched card input for this part of the work. Sorting, 'suspense' and 'interrogation' will be done, therefore, on conventional equipment, leaving the computer to deal with the main billing and accounting schedules. When the take-over of group accounts is complete, credit postings will be made at the rate of about 20,000 per day.

Wisely, the Board has refused to accept the idea that procedures, once set up, are sacrosanct. A number of changes have been made in the light of working experience; and the introduction of the second computer has been preceded by a period of reassessment.

First results (including a saving in labour which equals the full-time work of nearly 50 clerks) indicate that the outcome of the project will fully justify the time and effort which have been put into it. Some of the ultimate savings will be directly due to the use of electronic data processing equipment; others will be the natural consequences of changes in procedure which EDP has made possible.

AMERICAN REPORT

from John Diebold and Associates, New York

Intelligent Systems

—for problems that defy programming

A NEW and relatively unexplored area of computer utilisation is becoming the object of considerable interest on the part of data processing system designers and programmers. It has long been a corollary of data processing that a computer can only do what it is programmed to do. Consequently there are many problems which are not now being processed on a computer simply because it is virtually impossible to program them. It is this area—the solution of problems which are neither well-structured nor precisely defined—that appears to be the next major challenge in the application of data processing systems.

Even though we may not know specifically how to go about solving a problem, it is still possible to instruct a computer to search for the optimum method of solution. Unfortunately, this is enormously inefficient and may take so long to accomplish that the basic advantage of using a computer in the first place—its high speed capability—may be cancelled out.

According to Professor Marvin Minsky of the Department of Mathematics, in the Massachusetts Institute of Technology, there must be five stages of development which must be executed before a truly intelligent machine can be produced. He maintains that an intelligent system should be endowed with the following capabilities: coordinated search; pattern recognition; learning; planning, and induction.

BUILDING THE SYSTEM

When it becomes possible for a *pattern-recognition* capability to be incorporated in an ADP system, efficiency will be markedly improved. The new function will enable the system to automatically restrict itself to the more promising solution procedures. With the addition of a *learning* capability, efficiency should be improved by another order of magnitude because the search procedures can then be upgraded by the system that has been observed in the past.

When the system is able to analyse given situations, exercising what is generally known as a *planning* function, search operations would be narrowed to even smaller, less wasteful explorations. The final step would be the assumption by the system of an inductive capacity; an ability to construct general statement about events beyond its recorded experience.

Recent studies reveal that the truly intelligent system will probably be one or a combination of two types:

(1) A computer program known as a ' heuristic ' or self-learning program which can be utilised on large scale general purpose ADP systems;*

(2) special purpose systems which incorporate self-organising capabilities.

The difference between these two classes of systems is more a dissimilarity in degree than in kind. For the most part, the special purpose self-organising system uses hardware (*ie*, components and equipment) in place of heuristics to operate in an ' intelligent ' manner.

WHAT IS BEING DONE NOW

Some measure of the impact that the new future intelligent systems will exert on business systems can be gleaned from research projects which are now under way:

(a) *Language Theory and Symbolic Language.* This involves studies of methods for developing a universal and easily interpreted machine-communications facility. The work of Herbert A. Simon (Carnegie Institute of Technology), Allen C. Newell (The Rand Corporation), and J. C. Shaw (The Rand Corporation) on Information Processing Language (IPL IV and V), as well as ideas for a logic theory machine are significant examples of this.

(b) *Neural Net Analysis.* Investigations of the physiological aspects of the *cognitive* process in human beings, *ie*, recognition and learning.

* Heuristic in this context can be a solution procedure which is not necessarily foolproof and consequently cannot be guaranteed. Some describe it as a means-end analysis in which the end is stated in the form of acceptable characteristics rather than specific rules. Another interpretation: a quantitive description of a (particular) human being's problem solving technique.

(c) *Psychological Perception.* Experiments in this area are attempting to determine the relationship of visual perception to the motor processes;* *ie*, distorting and/or reversing the subject's impressions of his surroundings to determine if he is able to modify and correct responses in accordance with the new environment.

(d) *Recognition.* The Mark I Perceptron (built by Cornell Aeronautical Laboratory for the US Office of Naval Research) is a ' learning machine ' which responds to visual inputs. An array of photocells which are mounted in line with a photographic lens, enable the machine to ' recognise ' different patterns and symbols. Bell Laboratories performed most of the early work in machine recognition of sound. RCA followed this initial effort with development of a speech-actuated typewriter. The most sophisticated machine recognition system that has been developed so far now stands in the Laboratories of the Bulova Research and Development Corporation. It is a prototype of a system which could be used for the automatic routine of packages in a major post office. Its sensitivity is credited with being able to distinguish between such similarly sounding names as ' Pittsburgh ' and ' Fitchburg ' and ' Newark ' and ' New York '.

(e) *Language Translation.* The list of organisations engaged in the development of problems and systems for translation of languages is a long one. It includes: Thompson-Ramo-Wooldridge, The Rand Corporation, Georgetown University, the National Bureau of Standards, Harvard University, etc.

(f) *Problem Solving.* The work of Newell, Simon and Shaw is undoubtedly the most advanced now being performed. Their ' General Problem Solver ' is a system of methods which is claimed to be those commonly possessed by intelligent college students. These methods incorporated in special computer programs have proved to be helpful in many situations for which the individual does not possess special methods of attack.

TRUSTS, STORES SHOW THE WAY

There are several current problem-solving procedures which incorporate the heuristic approach. Although they cannot reasonable be cited as examples of heuristic programming, they do provide a guide to the direction which future systems will take.

Investment activity of a trust fund will be simulated by a ' heuristic ' problem which incorporates the general objectives of a trust (yield versus risk preferences, etc.). Then on the basis of information which will be fed into a computer operating with this program, predictions and guidance regarding basic and long-term investment opportunities will be developed.

Price and quantity decisions which a department store buyer must make are being simulated at the Carnegie Institute of Technology. The simulation involves such factors as: when will the buyer seek new alternatives (*ie*, new sources of supply); when will he re-evaluate sales forecasts; when will he use various hedging actions (*ie*, send unsold stock to the bargain basement or change the mix of high and low priced items on display). According to Fred M. Tonge of the Rand Corporation: ' Such a design procedure not only can specify price-quantity decisions in terms of cost, inventory, sales expectations, etc, but also can specify how and in what order these factors are re-considered if the apparent implications of the decision are not satisfactory.'

The assignment of workers to production lines so that a given production rate can be maintained with a minimum number of men is another problem that heuristic-type programs are being used to solve. The first step involves the aggregation of several jobs into a single, compound job. A series of simpler problems can then be used as a guide in applying limited exhaustive analyses to find a balance. If the program detects that the grouping of jobs into work stations is ' too easy ', it reduces the number of men assigned; if too difficult, the program will increase the number.

NEED TO REORGANISE THE COMPUTER

At the present time, a considerable degree of skill is required to use heuristic techniques successfully; for example, models must be designed very carefully. Also, the comprehensive analysis is needed to determine which factors should, or should not, be included.

However, the significant potential for heuristics is not embodied in the program. The computer itself will have to be fundamentally reorganised and improvements made in its speed capabilities. The Rand Corporation is currently working on a project which involves the combined talents of programmers and computer system designers. Although it is not likely that any new and revolutionary equipment ideas will be produced by this study, Rand does expect to produce a superior type of heuristic program—one that can be used on an extremely high speed data processing system. When this is available, the new equipment methods and techniques may become closer to fruition than they are now.

* Motor processes: nervous and muscular process inducing movement, conscious or involuntary.

Job Market Report

Demand for supervisors highlighted

Master and apprentice programmers

Scholarships for bright boffins

THE July–August period has shown a mild slackening in the number of vacancies advertised. There were only three Operational Research vacancies—though a couple of vacancies for consultants mentioned knowledge of OR as a desirable attribute; nine vacancies for programmers, and 22 vacancies for O and M/systems analysts. Lower down the scale, however, a gnawing shortage of punched card operators and supervisors—primarily for punched card complexes, is evidenced by the advertisements for these staff graduating from the humbler reaches of the office vacancies column into the two-column display spaces and the generously white-bordered advertisements in the general and executive columns. A random check over the nationals taken over two days at the beginning of August revealed five vacancies in bold type for punch and machine operators—including one for a computer installation; six advertisements for supervisors and two for punched card executives. There was a certain canny evasion on the subject of salaries, but in one or two cases there were details given, though evidence is not sufficient to establish a trend. However, it seemed that junior operators (experience desirable, but training given) would be offered from £7 to £10 per week, depending on qualifications, age and experience. Machine operators in Bradford were offered up to £650 per annum, and in London between £600 and £750, with experience a very definite factor in the salary scale. Supervisors—fully trained in all aspects of punched cards, with general background experience of accountancy—were offered up to £747 per annum in Bradford. However, for a man required to plan workflow and raise output, with ability to take charge of a punched cards department, salaries of between £1,000 and £1,400 were mentioned. For a man to take charge of a punched card unit for Gallup Polls, and to develop the present use of computers, a salary of more than £1,500 was envisaged; in fact it is expected that the man Gallup want will already be pulling in this salary. Thus the gaps between punched card executives, and the O and M systems analysts, both in work and in salary, seems to be slim indeed.

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It is interesting to note that many of the vacancies for cost accountants nowadays carry a rider that it is desirable—even essential, sometimes—that accountants should have a knowledge of punched card and mechanised accounting. From the accountants' stable also has come a new hybrid, the Accountant Administrator; he must have knowledge of accounting methods, the ability to control, recruit and train staff; and ability to develop mechanisation methods and carry out O and M procedures. Such a paragon can expect not less than £2,250 per annum.

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Physicists are in demand. Salford Electrical, a subsidiary of the GEC, want them for the development of their data processing equipments; so do Ferranti, and the Atomic Energy Commission. In order to harness the best brains one firm, J Langham Thompson, have offered senior and junior industrial fellowships to graduates, so that they can carry out their own research projects, into solid state and logical systems, cybernetics, etc. The scholarships are tenable for two years and research would be carried on in JLT's Watford laboratories. Much the same idea seems to have occurred to Bisra—the British Iron and Steel Research Association—who are offering two-year graduate apprenticeships in Oper-

ational Research. These two-year courses, to commence September, 1961, are spent partly on the job, with the steel manufacturers in the Bisra scheme, and partly at the London School of Economics. At the end of the two years the apprentices take the diploma examination in OR set by London University. Graduates accepted by Bisra have their fees paid, and in addition receive a salary while studying of between £700 and £800 per annum. The basic requirements of the apprentice graduate are good degrees in science, mathematics, statistics, economics or engineering.

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Bisra apprenticeships apart, there has been little movement in the OR field. Richard Thomas and Baldwins, one of the trainee establishments for Bisra, require a second project leader for their information handling and production control department at the Spencer works strip mill, scheduled to be the most modern and automated in Europe. Experience of OR, design of control systems, and the application of computers is essential. Another group leader will be needed in the future for another steelworks in the RTB group, to prepare the way for the possible introduction of a computer. An OR qualification is required by consultants Industrial Administration Ltd, for their industrial accounting and industrial engineering consultancy staff. Finally, a major manufacturing company, unnamed, are canvassing for an OR specialist to develop the application of operational research techniques in production, research, and commercial activities. The salary bait for this directing/developing job is £3,000 per annum.

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Applications for programmers again fall into two categories, trainee and senior. It seems as though the qualifications for the first grow less and less severe, while for the latter the requirements become more and more exacting; it must be noted, however, that salary figures match the growing expertise and responsibility required.

In the trainee field the petitioners are headed by ICT, who make a special appeal to grammar school leavers, with an 'O' level pass in mathematics and one other scientific subject. This seems a very low hurdle, more suitable for a punched card operator than a trainee programmer. Nielsen's, the market research people, as fitting to a firm based on Oxford, want a graduate trainee, who will be able to join a team programming a computer after only six months training. Johnson and Johnson of Slough, who ask for well-educated young men and women who would like to be trained in programming, offer a guide as to the starting salary offered to a trainee—£600 per annum.

Of the senior programming vacancies the best documented come from the Central Electricity Generating Board. First, the computers on which work will be done are specified—a Deuce, a Pace, an ICT 555 plugboard computer, and an IBM 709; an IBM 1401 is also said to be on the way. Next the categories of programmers are delineated; a theoretical and computer application group, who will work on special projects and applications from the formulation stage to the actual solving of the problem; staff required are applied mathematicians, physicists and statisticians. Also required are two other groups, mathematicians and programmers for optimising the operation of computers and for training programmers, and staff for analogue computer work; for the former category a desirable characteristic would be a knowledge of autocodes and compilers. The staff taken on would be either in a general grade, with a maximum salary of £1,375, or in one of eight special grades ranging from £1,205 to £1,460 up to a scale of £1,880 to £2,295. Ferranti and RTB also require programmers of this calibre, with at least two years experience on computers, preferably with magnetic tape storage. Other vacancies are available in EMI, in de Havilland (an ICT 1202) and in Rubery Owen (a 1202 leading to a 1301).

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In the O and M field systems analysts are again actively sought; firms canvassing are NCR, AEI (to assist the data processing controller of the Woolwich group to plan for a computer) United Glass, the Beecham Group (planning for an Orion) and two for an unnamed manufacturer. Salaries for analysts, when given, are in the £2,000 range; they are required to have an accounting qualification or to be graduates in economics or engineering; in addition to preparing the way for a computer by means of feasibility studies, they have to be able to modernise punched card complexes as a prelude to a changeover to computers. Tube Investments require an accountant with knowledge of systems analysis, to prepare for an IBM 7090/1401 installation; accountants with a systems analysis background are also needed by the CEGB (Midlands), though the salary range for these last is given as only £1,150 to £1,240.

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The other O and M vacancies are much of a kind; aged 25–30 or 35; salary range up to £1,300 or £1,500; where knowledge of computers is required the salary range is upjacked slightly. In two cases that of British Railways and AIC consultants, the salary range was pitched at £1,800 to £2,100, but in both cases computer experience was requisite. Among the named bidders this month in the O and M field were ICI, Fords (O and M training staff), Chloride Batteries, Murphy Radio, Petrofina, BX Plastics, and British Aluminium.

PROGRESS REPORT

Built to Order -

A production control problem solved

Vehicle builders AEC, finding their documentation handling was holding up production, became one of the pioneer users of a calculator punched card complex for production control

Derek Whipp

IF you take a look at any London Transport omnibus you will probably see the name AEC somewhere on the bodywork. For AEC Ltd, the Southall vehicle builders, are one of the principal makers of omnibuses for the LTE and other public transport bodies. In addition they build and export more than 350 types of vehicles, to customer specifications, to almost every part of the globe.

By the early 1950s AEC found that due to expanded production and other factors, the clerical handling of the various schedules necessary to the business was falling behind production requirements. The amount of clerical work required to produce suppliers' delivery schedules, factory schedules, and stock records seemed out of proportion, both in man hours and overhead costs, to the results achieved. Also there was the time factor. The information was not coming out of the pipeline quick enough. Despite all the efforts of an efficient and hard-worked staff, it was found that on a production programme, re-issued every three months, the re-scheduling of the part numbers, running to several thousands, took rather more than four months.

It was clear that a more efficient and economical system was needed, and in June 1956 an IBM punched card complex was installed. This was the first system for production control installed in this country. The system, revised in 1960 when an IBM 628 calculator replaced the original IBM 604, comprises the calculator, two accounting machines (an IBM 421 and dual-feed 441), a summary punch (565) and a reproducer (519).

Today, production is an integrated operation involving the Sales Department, the Data Processing Section and the Production Control Department. Meetings between these three bodies are held weekly to revise, up-date, amend and generally maintain an even flow in the workshop and stores, accommodating a very great number of variables which might justify the belief that exceptions never prove the rule.

Every vehicle that leaves Southall is made to customer specifications. Each is an individual job, and though one purchaser may order a hundred identical models to be delivered in small batches over a year or two, special orders of only two or three vehicles with non-standard components required at many points also have to fit the production scheduling for delivery by the specified date.

FIRST HAZARDS

At the beginning a conventional stock control job was programmed and performed on the 604. Then it was found that only one-tenth of the

information produced was being used. Realisation of this fact inspired another look at the company's needs. Already a reasonably efficient and well-established system worked on the shop floor. The data processing equipment would need to implement that system.

'We completely revised the machine's functions,' said Mr S H Graves, AEC's data processing manager. 'Now basically the Data Processing Section works out *what* is wanted, and *how* it is wanted. We are told what is wanted by the Sales Division which gives us a bulk order for vehicles—500 for one customer, 100 for another, to be delivered in batches and spread over as long as two years. This order, sanctioned by the Board, comes through to the DPS as an instruction.'

A typical chart containing such instructions lay before Mr Graves. It was a *pro forma* sheet with the first column consisting of about 150 basic vehicle type names. (There are more than 350 AEC vehicle types, but the extensions from the basic are accommodated at a later stage.) Column two contained the code number of the vehicles, followed by a block of columns specifying despatch dates and quantity; particulars of engines and gear boxes went in succeeding columns, and further details filled the page.

On the chart were various amendments, pencilled in as a result of one of the weekly meetings. The Production control department had shown from information provided by the DPS that they would find it awkward to meet the delivery estimates as previously planned, since components had been switched for a priority order, and one section of the shop was overloaded, etc. The Sales Department agreed that the order could be deferred until the next meeting, provided the shipping date was still within compass. Thus shop loading is controlled by maximum exchange of information and smooth component flow.

After receiving the order from the Sales department, the DP section break it down into component parts. It is somewhat similar to quantity surveying in the building industry, except that action is initiated almost at once. This acts as a requisition on the Buying department, indicating what must be put into the pipeline. Most of AEC's components are supplied by contract, and the departments need to know and order what will be wanted long before assembly begins. It does not say *when* it will be needed; that is another operation.

Components must be ordered to ensure they will be available for the required date. This never happens precisely as planned, but by having the information available readily it is possible to accommodate all the variations. Once this is done the production programme can be adjusted according to the vacuums and pressures that reveal themselves. As Mr Graves put it, in a sense this is a shop window dummy waiting to be draped while the dresser positions the other dummies and assembles all the garments.

THE PROBLEM OF THE VARIABLES

The work involved in accommodating all the variables came out when Mr Graves picked up a document relating to amendments in an order for two vehicles. Compared with those of AEC, the mass production lines for popular vehicles at other factories is almost straightforward, but because each Southall vehicle is built to customer specifications, the variables are enormously complex. The Data Processing Section there has the task of ironing out this complexity, and it is this which makes their system unique. The amendments document in Mr Graves's hand ran into five pages much larger than foolscap.

'We still do a raw material stock control,' he said. 'This is a fairly simple control on punched cards of our total receipts, issues, and balance. We abandoned the more elaborate stock control job because it was not really accurate. It suffered from human frailties. . . . No programmer has yet been able to find an answer to that one. And in any case it was producing unnecessary data. We found we were duplicating what we had on the master punched cards.'

KEEPING THE AUDITORS HAPPY

But one operation provided an instance of making virtue out of necessity; a job connected with the auditors' needs.

Up to the time that the DP system was installed a statement had to be prepared every April of all stock held. This involved tracing holdings in store, issued, and in various stages along the production line, ensuring that everything was located, marked down or written off. All this information is now collected by the DPS and used for controlling stock holding and scheduling. There is a physical stock-taking every third year, as well as a continuous internal audit, and overall we manage to keep a close control of the stock situation. This is essential for maintaining even flow, apart from telling the auditors what they want to know.

The original stock control system was useful in the sense that it introduced the philosophy of data processing to this company, though the mistakes—or perhaps they should be called misapplications—led to the framing of a new system. A punched card accounting system had been installed there thirty years previously, but it operated with only moderate success and was discarded at the end of two years. In that sense, data processing was virtually a novelty, particularly for production control, and the experiment with stock control is now viewed as an instructive preliminary canter.

The knowledge gained and the decision to

abandon it has produced a satisfactory system which is already handling twelve functions, with more projected for future inclusion. One of these is the preparation of the machine load for the whole of the factory so that information arrives well in advance of the peak periods where action is required to spread the load more evenly.

The knowledge gained—including the decision to abandon it—has produced a system which is wholly satisfactory. Since the installation production has risen 200 percent, and this has been accommodated on the system without any delay or slowdown. More functions are being put on the system; already twelve are being handled, and more are projected for future inclusion. One of these is the preparation for the machine load of the whole of the factory so that information arrives well in advance of the peak periods, and action can be taken promptly to spread the load more evenly.

STAFF TRAINING

The installation has been immediately responsible for impressive time saving, and the staff who formerly operated the less efficient manual methods are now engaged on more rewarding work. The operators for the data processing section are selected in the main from inside the AEC organisation, and trained for the job. In this way they have already learned something of the business, and are familiar with the part number system. For that reason they are more useful than experienced punch operators from other companies who might be efficient operationally but who would unwittingly let an incorrect part number through. In fact, the punch operators have acquired some status as part of the check system, though they would not be blamed for failing to spot somebody else's inaccuracy.

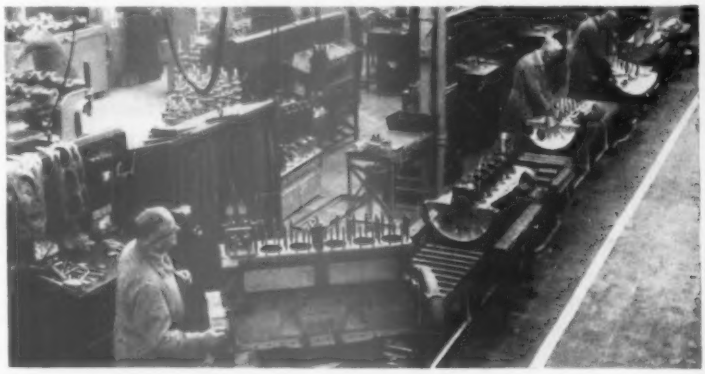
For the same reason, the male DPS staff is drawn from other offices within the organisation. It has been found easier to teach those with a general knowledge of the routine how to use the machines than to recruit an experienced outsider who is ignorant of the company's internal procedures.

EXPANSION BEFORE CHANGE

In looking into the future AEC envisage that the time may come when a computer may become necessary—when more departments are concerned with the activities of the data processing section, but for the moment the 628 system is adequate. However, they are carrying out studies to optimise performance and to prepare for future change. Recently they investigated the possibilities of adding magnetic tapes to the punched card complex, but found that it was not at the moment justified.

A major reason for this, and for the prediction that the system would continue to be based on punched cards, lay in the number of engineering changes which were being made all the time. It was reckoned that a change of this kind occurred every 50 minutes. This would mean very little as far as the component was concerned, but it meant that a new part number had to be created. In addition, the old card had to be retained, because customers might need replacements. The library of cards was thus being constantly changed, and there seemed little point in going over to a magnetic tape system that would need to be revised every day.

The logical attitude towards mixing a well-tried system with a data processing operation was epitomised in AEC's attitude to the question of revising part numbers. Some numbers were longer by two or three symbols than others, making accommodation on the card a careful business. Clearly from the data processing angle it would have been better to have revised the numbers when the system was first installed, so that they were all of uniform length.



Each Southall vehicle is built to customer specifications.

'I suppose it might have been tidier for the data processing section if we standardised all our part numbers,' said Mr Graves. 'Certainly faster machine times would result. But we decided that the disadvantages would more than offset the gains. If the part numbers were changed everyone in the factory would be affected; it might take years before we reached the same degree of smoothness. It would mean a temporary upheaval which might have serious consequences to the production rate, and it might not stop there. Agents, depots, users, people all over the world would be involved; they would all need to be re-educated. We gave it a good deal of thought and in the end we concluded it was not worth the trouble.'

'Besides, we have always made the machine do what we wanted it to do. We feel the machine must be the slave of the company, instead of the company finding itself submitting to the demands of the machine.'

Our special correspondent comments on the papers to be presented at the Symposium on 4th–6th October, their probable content and those likely to be of interest

What will they say?

By Robert McKinnon

THE most striking impressions and one that emerges from even a casual study of the contents of the forthcoming Computer Symposium at Olympia is of a break-through on a wide front. This is implicit in the titles of the papers, not one of which contains a phrase such as 'Possible Uses', 'Some Tentative Experiments' or 'Initial Results'. All the papers are either about ADP installations now being operated or about techniques and problems on which much is already known. Could it be that the 'blue sky thinking' so freely condemned at the time of the first Computer Exhibition in November/December 1958 has not proved wholly chimerical?

The programme also underlines the wide variety of organisations now using computers. This, it is true, is something well enough known already; even so, it is encouraging to see printed evidence of data processing activity in fields as diverse as Government departments, banking, insurance, oil, electricity, pharmaceuticals, steel and the manufacture of automobiles, canned foods and razor blades, to mention only some items on the programme.

Altogether there will be 26 papers on the three-day menu and most of them will stress the business as distinct from technical aspects of computer installations. In the words of Mr G W Cushing, chairman of the Symposium Committee, 'the papers will be concerned with the general subject of earning from computers . . . that is, with the methods that are being devised to achieve the more efficient use of capital, taken in its widest sense'.

This is as it should be. The basic purpose of the Symposium as well as of the Exhibition is to convince managements of the usefulness of ADP installations while at the same time discussing the problems involved fully and frankly. Managements are more interested in *what* an installation can do than in *how* it works, something which in any case can hardly be satisfactorily explained from a platform. And in any case the Symposium will be daunting enough. Even the most capacious mind would find it difficult to sit through the entire proceedings without feeling stunned by a mass of facts and figures.

This brings us to a possible point of criticism about the programme. It contains perhaps too many case histories. Room might have been found for one or two papers of a more general character—one, for instance, on *The Market for Computers* and maybe one on *Personnel Problems*. On the other hand, the wider the range of practical examples, the wider inevitably will be the Symposium's appeal.

The papers have been grouped under four main heads though there is a certain amount of overlap among the first three. First come seven papers grouped under the title *Then and Now—a Record of Progress*. This is followed on the second day by nine papers on preparing and operating computer systems. Each paper describes an installation actually at work in some industry or commercial activity, its objectives and its results. On the third day there will be two smaller sessions, the first in the form of a Brains Trust which will discuss the various types of job now being handled by the Computer Bureaux, while the second looks at present and future developments in a group of papers entitled 'The Place of the Programmer', 'Character Recognition' and 'New Equipment'.

Not all the papers were available at the time of writing, so there may be some surprises in store. From those which were to hand, however, it is obvious that we are in for an intellectual marathon.

FIRST SESSION

Government departments, insurance, and manufacture of cars, steel, pharmaceuticals and data processing equipment itself are among the activi-

ties which will be featured in the first session. Of special interest should be the paper by J Grant of ICT on his company's production control system at its Letchworth factory. This is one of the pioneer industrial applications of computers in Britain and an 'old favourite'. Its early operations were described in the first issue of this journal, and the progress made since should merit further study. Also of interest should be the paper by J D Janes of H M Treasury on 'Progress in the Introduction of Automatic Data Processing in Government Departments'. The Civil Service is usually lampooned for fossilised thinking, so it is most refreshing to place on record that it has been quicker than most branches of industry and commerce to grasp the advantages of modern data processing techniques.

Another paper in this group which should attract a lot of attention is the one being given by Herr K E Schang of the Trygg-Fylgia insurance combine in Sweden. British insurance companies are now taking a keen interest in computer systems, so the Trygg-Fylgia experience should be well worth hearing. Briefly, it is that the company has been handling one million policies on a *Perseus* installation which began operations in October last year. Although there are a number of problems still to be solved, to date the savings amount to a figure which corresponds to a revenue of 20 percent on the total investment in the system.

Another paper in the same category as Mr Grant's is that by Mr N C Pollock of Stewarts & Lloyds, entitled 'Three and a Half Years' Experience'. This will report further progress of a system which was first described at the 1958 Symposium,

SYMPOSIUM DIARY 4TH—6TH OCTOBER 1961

Wednesday 4th October **Morning** 10.15 a.m.—12-30 p.m.

'Progress in the Introduction of Automatic Data Processing in Government Departments'	J. D. JANES—H.M. Treasury
'Production Control Scheme for Letchworth Factory'	J. GRANT—International Computers & Tabulators Ltd.
'Inventory Control, Accounting & Payroll'	A. BRADLEY—Ford Motor Co. Ltd.

Afternoon 2.30 p.m.—4.45 p.m.

'Establishing Electronic Data Processing at the Trygg-Fylgia Insurance Companies—Stockholm'	K-E. SCHANG—Trygg-Fylgia Insurance Co's Group Sweden.
'3½ years practical experience'	N. C. POLLOCK—Stewarts & Lloyds Ltd.
'Invoicing'	A. J. BROCKBANK—Glaxo Laboratories Ltd.
'Production Control by Hiring Computer Time'	R. B. BAGGETT—Job White & Sons Ltd.

Thursday 5th October **Morning** 10.15 a.m.—12.30 p.m.

'Provisioning 1300 Shops'	D. S. GREENSMITH—Boots Pure Drug Co. Ltd.
'Data Processing in Commerce'	L. G. BONNEY—Crosse & Blackwell Ltd.
'Use of a Computer in Banking'	J. LETHAM—The Bank of Scotland
'Using a Computer for Insurance Work'	F. C. KNIGHT—Commercial Union Assurance Co. Ltd.

Afternoon 2.30 p.m.—4.45. p.m.

'An approach to Integrated Production Control'	W. J. KEASE—A.E.I.—Hotpoint Ltd.
'Commercial Planning for an Integrated Oil Company'	W. P. BROWN—Shell International Petroleum Co. Ltd.
'Recording and Controlling Production Stocks'	D. O. BELL—Standard-Triumph International Ltd.
'Finished Stock Control, Production Monitoring, Sales, Statistics, etc.'	F. STUBBS—A.E.I. Ltd.
'Production Planning'	J. ANTILL—Rubery, Owen & Co. Ltd.

Friday 6th October **Morning** 10.15 a.m.—12.30 p.m.

'Survey of the Computer Bureaux Service'	D. W. HOOPER—The British Computer Society
'Structural Stress Calculations'	DR. C. P. WROTH—G. Maunsell and Partners
'Costing Oil Drilling Operations'	G. DE VERTEUIL—Schlumberger Overseas S.A.
'Planned Stock Control'	C. H. BAYLISS—The Ever Ready Co. (Great Britain) Ltd.
'Keeping an Inventory of Precious Metals'	S. A. EMERY—Engelhard Industries Ltd.
'Evaluation of Confidential Materials'	A. J. STEVENSON—Stevenson & Howell Ltd.
'A Market Survey'	H. WORMALD—Midlands Electricity Board.

BRAINS TRUST—Chairman—D. W. HOOPER—The British Computer Society.

Afternoon 2.30 p.m.—4.45 p.m.

'The Place of the Programmer'	DR. S. GILL—Ferranti Ltd.
'Character Recognition'	DR. M. B. CLOWES, J. R. PARKS—National Physical Laboratory.
'New Equipment'	DR. A. S. DOUGLAS—C.E.I.R.(U.K.) Ltd.

including mistakes made and lessons learned. From the car industry—a 'natural' for computers, if ever there was—there will be a paper by A Bradley of the Ford Motor Co Ltd, on 'Inventory Control, Accounting and Payroll'. This describes work on the company's *Leo* installation which was set up early in 1959. It handles invoicing and inventory control of spare parts, involving 30,000 items daily, and now the payroll for 30,000 employees is being transferred to the installation. Future plans cover the control of production material requirements and stocks.

SESSION TWO

Data Processing in Commerce and Industry is the title of the second group of papers, though their contents have little basic difference from those in the first group save that they describe application of more recent vintage. One of the most interesting papers has, once again, insurance for it subject. It is by Mr F C Knight of the Commercial Union Insurance Co Ltd, a group which is to use a KDP 10 installation with ten magnetic tape stations to handle its five million UK policies. Each branch office will transmit data daily by wire to the Computer Centre, which will also do a number of other jobs such as staff salaries and dividends.

Other papers for this session include accounts of automatic data processing in Boots, in the Bank of Scotland, Crosse & Blackwell Ltd, Hotpoint Ltd, in Shell, Standard-Triumph, in AEI and in Rubery Owen & Co Ltd. It is certainly a mixed bag, and one cannot expect at this stage names of medium-sized firms to appear on the bill of computer fare. Yet there must be hundreds of such firms with similar problems to their big brothers, though on a smaller scale. What, then, is the future for a really small computer?

Most of the papers in the second session are concerned with invoicing and stock and production control, and each has something of special value to managements in its own line of business. Singling out any may, therefore, seem invidious, but the paper by W J Kease of Hotpoint Ltd on 'An Approach to Integrated Production Control' looks as if it will attract a wide audience. The paper is in three parts, the first of which describes the situation which was to be controlled and the factors which influenced the company in its choice of computer. The second part reports how the system was developed, while the third deals with progress made and benefits to date.

Another paper which may make a very wide appeal is that being given by L G Bonney of Crosse & Blackwell Ltd. This casts its net wide and begins by posing then answering the question 'What is data processing?' Next, it asks 'Why a computer?', and answers this with an analysis of the reasons why automatic data processing is superior to manual and mechanical methods. The third part ranges over all the factors to be taken into account when actually installing a system, including the selection of suitable staff and how to conduct a feasibility study, and the fourth and last part summarises the results of the company's own project.

SESSION THREE

The third session deals with *Buying Time on a Computer* and will highlight what can be done for the small user. As stated, this session will take the form of a Brains Trust, but there will be seven main speakers. D W Hooper of the British Computer Society will kick off with a 'Survey of the Computer Bureaux Service'. He will be followed by Dr C P Wroth (G Maunsell and Partners) who will speak on 'Structural Stress Calculations' then by Mr G de Verteuil who will give an account of 'Costing Oil Drilling Operations' from tapes sent by engineers at oilfields in the Middle and Far East to the London headquarters of Schlumberger Overseas S.A. Mr Verteuil is followed by Mr C H Bayliss of the Ever Ready Co (Great Britain) Ltd, who will speak on 'Planned Stock Control', then we have two papers with a cloak and dagger flavour entitled respectively 'Keeping an Inventory of Precious Metals' and 'Evaluation of Secret Materials'. In conclusion, Mr H Wormald of the Midlands Electricity Board brings us back to business with 'A Market Survey' of his commodity.

SESSION FOUR

The papers in this session should all be worth the closest attention, though one more on human and technical problems to have emerged to date would have been welcome. Dr S Gill of the British Computer Society will describe the expanding responsibility of the programmer and his increasingly intimate association with machine design. Dr M B Clowes and J R Parks of the National Physical Laboratory will speak on the role of character recognition in data processing, on the range of systems employed in automatic processing of alphanumerical data, including parallel-code techniques and on-line recognition of hand-written characters, on forming criteria by which industry can select the most appropriate techniques for a given problem, and on future trends and needs.

Finally, there will be the paper on 'New Equipment' by Dr A S Douglas of CEIR (UK) Ltd. This is not to hand, but no doubt he will have something to say on the so-called 'intelligent machine' which, we are told, is already on the horizon.

To sum up, this is likely to prove a most worthwhile get-together, even though the mixture is somewhat as before. And as at the 1958 Symposium, we hope that snags and difficulties are as honestly presented as the successes.

Punched Card Systems

A handicap of automatic key-punch operation is that it is slow and expensive in manpower overheads. Even with AKPs incorporating automatic gang-punching and interpreting facilities, the speed of card preparation is not much above that of manual typewriting *ie.* 5-8 digits per second.

An equipment which assists in lifting the load off the punched card operator is the reproducing punch. This machine is able to carry out four functions, reproducing, gang punching, summary punching or mark sensing. In addition, it can be linked to an accounting machine, or a Kimball tag system to allow punched cards to be produced as a by-product of a previous operation.

The term reproducing needs to be qualified; for most people it means duplication of cards on a one-for-one basis, with information omitted, added, or reproduced in different columns. The punched cards are placed on the reading track of the reproducer, and a pack of blank cards on the punching track cards are fed simultaneously to each track, and read or punched; certain equipments allow for checking the correctness of the punching by two sets of brushes located at the output tracks.

In this section we conclude the review of auxiliary equipments used in conjunction with the basic punched card complex. (In the July issue we described punches, verifiers and sorters; in the August issue tabulators and summary punches). The equipment under scrutiny this month comprises, reproducing punches, collators, interpreters, multipliers and calculators, manufactured by IBM and De La Rue Bull Machines; up to date information on ICT machines is not currently available.

Gang-punching consists of systematically punching each card of a batch with information held on a master card. The information to be punched is stored, and punched into successive cards until the next master card is reached. The accuracy of punching is then verified, either simultaneously or by passing the cards through the reading track where successive cards can be compared to ensure continuing accuracy.

Summary punching has been described in an earlier section. Though there are machines designed specifically for this function, most if not all of the reproducing punches can be cable connected to a tabulator to punch out into summary cards. On some equipments summary and gang punching can be done simultaneously.

Mark-sensing is an effective way of by-passing the preliminary punching operation. The punched card is divided into two fields, one for punching and one for pencil entries. The meter reader/stock control clerk/HP salesman or Stock Exchange clerk—depending on the applications—makes the cards in specially designated panels; these cards are passed through a mark sensing device which may be integral part of the reproducer or cable connected to it. There the pencil mark is spanned by three electrical contacts, the current flowing down the outer two via the pencil mark to the centre contact, where it is converted into a stroke on the punch mechanism. In this way both the individual punching and verifying operations are avoided.

In addition to the facilities mentioned certain reproducing punches have an end-printing facility, allowing up to two positions of printing to be incorporated on the same or following cards. The IBM 513, 514, and 519, the latter known as the Document Originating Machine.

The De La Rue Bull PRD

This machine, which operates at 120 cards per minute, is able to punch, reproduce and duplicate cards. An electronic device can be attached to allow mark scanning.

The reproducer consists of six basic units, a reading unit with five reading stations and two tracks on which two sets of cards can be read simultaneously; a timing device controlling the card tracks, which allows simultaneous or alternate feeding as required; a storage and punching device which allows data to be stored and punched with a matrix of 960 punching knives; a selection unit for determining which field shall be read and punched, and which cards need to be read or skipped; and a checking unit which automatically verifies punching on all columns of the card, stopping the machine and indicating the type of error when a discrepancy is detected. In addition, there is a device for supplying both numerical and alphabetic constants from the digit emitter.

The machine can gang punch, the information from the master card being stored in the punch block matrix and punched in successive detail cards. When extra relay memory units are added grouped information may be extracted from several master cards and punched into detail cards. The punched cards are verified by placing them in the reading track of the machine, and comparing successive pairs of cards, the two tracks being used independently of each other in this operation.

The IBM 513/514

These two machines are similar in operation so that the same specification will describe them both. They are able to carry out reproduction, gang punching, and mark sensing at speeds of 100 cards per minute; they can also be connected to a tabulator to act as summary punches, operating at 1·2 seconds per summary card.

As with the PRD the 513/514 can carry on several operations simultaneously, under control of a plugboard panel. Checking is carried on simultaneously with the punching, 45 or 80 columns of comparing being provided.

When mark sensing is carried on up to 27 positions of mark sensing are available, with double punch and blank column detection to check the punching accuracy.

The IBM 519

This machine, known as the Document Originating Machine, is a slightly more sophisticated machine, which can carry out reproduction, gang-punching, mark-sensing and punching and end-printing. When carrying out these operations it functions at a speed of 100 cards per minute. It is also able to carry out simultaneous gang and summary punching.

Up to eight characters can be printed out on each of two lines along the left hand end of the card, or into the card following that from which data is read.

Checking of marked sensed punching on 27 columns is assured by up to 30 positions of double punch and blank column detection.

Reproducing or gang punching is checked for accuracy by the provision of 45 or 80 comparing positions. Optional features include an auxiliary card counter, offset stackers, up to four 10-position selectors, and facilities for consecutive number gang punching.

INTERPRETING THE CARDS

The interpreting function consists of passing the punched cards through a machine which will sense the holes punched in the card, and translate the information into printed characters, printing out the data on to the same or on to following cards.

Though it is possible to carry out the interpreting function, as a by-product of some other operation, many of the most up-to-date key punches summary and reproducing punches having printing facilities, it is more usual to have a special equipment, known as an interpreter, to carry out this operation. In this way punched cards may be able to serve as source dockets in the control of materials, or in production, or can be used as indexes or in accounting and invoicing.

A refinement of this system enables a ledger posting operation to be carried automatically on a special interpreter known as a posting interpreter, which allows the information on one card to be printed out on another card in sequential order. In this way successive Hire purchase or similar recurring payments can be printed out on to a ledger card, one entry below the other, thereby updating the account automatically. The sensing/printing operation is directed from a control plugboard, so that the whole of the data, or only selected parts, can be printed out; on some equipments the plugboard can also determine the position on the card where the printing can be carried out.

The IBM 548 and 552

These two machines are similar in operation and capacity and handle 80-column cards, printing out both alphabetic and numeric data.

Two lines of printing—each with a capacity of 60 characters or card columns—can be printed along the top of the card. If required, the data can be printed anywhere along the card, subject to the wiring of the control panel. If a repeat printing device an optional equipment, is incorporated, a third printing line can be added, and the machine will then be able to print data from a master card on to following cards. Printing is by means of a number of printing wheels.

The control unit consists of two five-position selectors and five ' x ' brushes for sensing the cards. The position and content of the printed line can be selected manually. Up to 20 positions of zero suppression are possible.

The card reading/interpreting function is carried out at a speed of 60 cards a minute. The 552 (model 2) acts as posting interpreter, allowing a ledger card to be printed automatically with the information from punched cards. Either 13 or 19 lines of 60 characters

can be printed in the required position as set by the automatic line selector. The speed of operation of the Model 2 is 60 cards per minute.

The IBM 557 (Models 1, 2 and 3)

The 557 serves both as an interpreter and as a ledger posting device, with a printing/interpeting speed of 100 cards per minute.

Up to 25 lines of 60 characters (or columns) can be printed on the card, horizontally according to a manually operated printing position dial. On Model 3 50 lines of 30 characters can be printed. An interpret emitter generates and prints each separate character within the machine.

A special feature available is the repeat print device which permits information read from a master card to be printed into matching detail cards. A pre-sensing station controls this device and also the selection of alphabetic information. A card-to-card comparing device checks that printing only occurs from the master into the matched detail cards.

Automatic line selection, enabling details from a punched card to be printed on the appropriate line of a ledger card, is possible on this machine. The zero suppression feature, optional on previous models, is incorporated as standard on this machine. The cards after printing can be grouped, according the plugboard panel, and filed into any of four stackers (two standard, with two as optional features). An auxiliary card counter can also be incorporated to provide a running total of cards passing through the machine—except for those in which an error has been detected.

The De La Rue Bull Interpreters

There are two machines; the column-by-column interpreter is designed for small and medium sized punched card installations. It is a box-shape and designed for use on a table. It operates at a speed of 800–1,000 cards per hour. The other equipment, the 80/80, is a block punch operating at 3,600 cards per hour.

The De La Rue Bull Posting Interpreter

This machine, known as the posting interpreter, is designed to be a high speed, line selecting, automatic ledger posting machine; it can function as an interpreter or in preparing receipts or vouchers for stock. The details punched on an 80-column detail card are read on one track and automatically printed on the second track on the appropriate ledger card.

The basic complex of the posting interpreter comprises two card tracks one for reading and one for printing and a comparison device for checking that the two packs are correct; and selection devices for choosing the card fields and/or the next line to be printed.

The reading track has 80 reading stations and feeds to two receiving hoppers allowing the cards read to be split into two packs if required. If a relay memory unit is attached to the interpreter, group constants kept on the first card of each group can be printed on each card. The printing track receives the accounts cards and identifies the account number, which it then interprets on the cards. It is fitted with a printing block of 80 wheels, so that when the line selecting device has chosen the next line to be printed up to 80 columns are printed out in a single pass of the machine.

The reading/printing speed of the posting interpreter is 65 cards a minute, and up to 38 lines can be accommodated on the two sides of the card.

COLLATING THE CARDS

This operation is auxiliary to the sorting operation, and is employed when master and detail cards have to be merged in order in a single pack, segregating the master cards without detail cards, and detail cards without master cards. It is also used to check that cards in a pack are filed into correct sequence. The machine used for this operation is the collator; this has two card feeds on to which two packs can be loaded, and merged or matched according to the comparison/selection devices controlled by the wiring of the plugboard panel. The collator also allows the selection of cards containing a number, or between a sequence of numbers, from a pack filed in random order.

The De La Rue Bull Collator

This machine consists of two reading tracks, each incorporating two reading heads; a comparison unit, selection unit, and recording unit. It operates at a speed of 500 cards per minute, when merging is being carried out on a single pack; each card track has a speed of 250 cards a minute.

The card reading tracks route the cards to the reception tracks according to the value and nature of the information punched. Each track has two stackers, one of which is common to both tracks. Using the four reading stations it is possible to merge two packs, checking the sorting on both tracks and selecting the unmatched cards on each; it is also possible to verify the sorting on one track and select cards on the other.

In the first part of this section of the Survey reviewing punched card equipment, published in July, a number of errors were unfortunately made in describing ICT automatic punches and verifiers.

The ICT range of 80-column automatic punches comprises three machines (Types 29, 30, and 34). The Type 29 is an electrically-powered punch, which automatically feeds and ejects cards. It features moveable alphanumerical or numerical keyboards, and functions like skipping, controlled spacing and gang punching are under the control of interchangeable plugged panels. Type 30 is similar to Type 29, but has increased gang punching facilities. With this machine common information can be carried forward from previous cards via a gang-punching drum. Type 34 incorporates storing facilities for all the 960 possible positions on an 80-column card (i.e. 12 by 80), so that when punching all the columns are punched in one action. Thus in case of mistakes key entries can be cancelled before punching. Also incorporated are facilities for reproducing master information. The machine can be used as a high speed gang punch with an automatic control on the number of cards produced.

The ICT range of 21–40 and 160 column automatic key punches features facilities for storing and correcting information before punching. All punches can 'ovalise' holes prior to automatic verification, and can be used as gang punches.

Reference was made to the ICT Type 327 sorter for 40-column cards and its operating speed given as 650 cards an hour—this should, of course, have been 650 cards *a minute* (or 40,000 cards an hour). A Type 326 sorter is also offered for 21-column cards and operates at the same speed.

For 80-column cards ICT have also a Type 313 sorter which sorts at 45,000 cards an hour.

We apologise to readers and to ICT for these errors and omissions. *Editor.*

The comparison unit consists of 17 integral and independent comparators which allow 17 parameters relating to 90 columns of the two cards in either pack to be coupled as desired. The recording unit, electrical recorders set from the control panel, allow 30 positions to be allocated to any comparator or either of the reading tracks.

The IBM 077

This machine consists of two reading tracks, feeding to four output pockets and a comparison selector unit, operating under a plugboard program. It operates at a speed of from 240 to 480 cards per minute, the cards being compared, and—according to the control fields punched in the cards—matched or merged, with or without selection. The basic 077 is employed for collating numerical information only but an alphabetic collating device can be added.

The control device consists of two control units of 16 positions each which can be used separately or in combination; selection is by five one-position control impulse selectors, one minor and one secondary.

One or two auxiliary card counters, and a collator counting device may also be added to the installation. These will enable sequence checking to be carried out both feeds—the basic model only allows for checking that the cards on one feed are in sequence.

The 077 is able to pull or file cards automatically; merge cards in sequence; separate matched and unmatched cards into the output hoppers, and to select cards bearing a certain number, or within a certain range from a pack loaded in random order. The card counters will assist this process, and will enable cards to be inserted from one feed in front or behind cards from the second feed at set intervals.

The IBM 088

A development of the 077, this is a high speed machine, consisting of two card feeds feeding to five output pockets—radial stackers, holding up to 1,000 cards each; with a more flexible and versatile comparison/selection unit. It operates at a speed from 650 to 1,300 cards per minute.

The cards are fed into two input hoppers leading to two card reading tracks; attached to the primary hopper is a file feed, with a capacity of 3,600 cards. According to the control fields compared the machine matches or merges cards, with or without selection into the five radial stackers.

Control of the operation is through a plugboard panel, and three control units each of up to 22 positions each, used separately or in combination.

Selection is through five two-position recode selectors; 15 additional two-position recode selectors can be added to the installation.

This model incorporates sequence checking on both feeds as a standard feature, and also double punch and blank column detection. An auxiliary card counter can be added to the equipment to control merging or matching at set intervals.

CALCULATING EQUIPMENT

Whereas on a basic punched card system addition and subtraction can be carried out, there is no facility for multiplication or division. This facility is provided by the punched card calculator. The more advanced calculations differ only from computers in that their program is controlled by a control plugboard instead of, as in a computer, by means of a program stored in core or magnetic drum storage. The number of program steps range from some 14 up to 128.

There are two types of calculating unit, the electronic multiplying punch and the electronic calculator. The multiplying punch was the forerunner of the calculator, and several models, notably the IBM 602, the ICT EMP and the ICT 542 were developed. However, of these only the ICT 542 is a current production model.

There are seven punched calculators, the IBM 609, 644, 626, and 628; the ICT 550 and 55 and the De La Rue Bull Gamma 3.

The IBM 609

This is a single unit machine, governed by a plugboard panel which incorporates a flexible program unit. It is fully transistorised, and uses magnetic cores for high speed access to information.

The 609 operates at a speed of up to 12,000 cards per hour (200 cpm) and is able to carry out addition, subtraction, multiplication and division. Representative times for these four functions are: addition—0·224 to 0·392 milliseconds, depending if six or 12 digit fields are entailed; subtraction—0·35 to 0·602 milliseconds; multiplication—4·78 to 13·86 milliseconds; and division 10·29 to 17·64 milliseconds. The machine is also able to work directly in sterling.

Up to 144 program steps can be carried out by means of the plugboard, in any order. Steps may be repeated as often as the logical tests made during calculations or the input data required.

The fast access core storage is capable of direct add-to-store arithmetic, which reduces the number of program steps required for calculation, since there is no need to check arithmetic. Either six or 12 digit words, of the add-to-store type, can be stored, the storage having a maximum capacity of up to 384 binary coded decimal digits. Each word in the store can be individually addressed. The storage can comprise up to 144 positions of input storage, 144 positions of working storage and 96 positions of output storage.

In the calculation operation the cards are put on the input feed, and each is read, the factors being calculated and the results punched into the same card or into following cards or cards in a continuous sequence In the event of the calculation being of a complex nature, the card passage and punching could be delayed by the wired program to enable the calculation to be completed in time. Calculation is based on a cycle time

of 14 microseconds, and the time allowed for calculation per card is 110 milliseconds.

After punching the card (or cards) will be passed to one of the three radial output stackers. Thus the output stacking can be selective, and cards may be sorted into groups as required, subject to the plugboard programming. Each stacker holds up to 1,000 cards.

There are several checking facilities built into the machine, which may be carried out without express programming. On the output data, parity checking, validity checking and double punch and blank column checks can be carried out; on input data validity, and blank and double column checking. Zero checking in and unfinished program checks are provided.

The IBM 644

This machine comprises two units, a calculating unit and a card reading punch, the IBM 564, which is cable connected to the calculating unit.

The 564 allows cards to be inserted in the input feed and passed continuously through primary reading, punching and secondary reading stations, during the course of which the factors are extracted, calculated on the unit, and punched into the card; the punched result of the input factors and the calculation are read back into the machine at the secondary reading station, to allow them to be subtracted from the result to produce a zero balance. Three cards may be handled at any one time, reading, punching, and checking, on the three stations of the machine.

The card handling speed of the punch-calculator is 3,000 cards per hour (50 cpm) and is able to carry out the four arithmetic functions and work directly in sterling. Up to 70 program steps can be carried out, and whereas the steps cannot be taken in variable order, steps can be taken selectively, singly or in blocks, and the remaining steps suppressed, and the program can be repeated either as a whole or in part. A program test feature allows the operator to check on a neon display panel, that the program as written accords with the contents of each storage register.

Storage on the calculator consists of four five-position units, and four three-position units. In addition the calculator unit consists of a 13 position counter and a multiplier quotient unit. Typical calculation performed on the 644 are; addition/subtraction factors up to 13 positions can be accumulated; in multiplication a 8 digit multiplicand may be multiplied by a 5 digit multiplier to produce a 13 digit product, larger factors being calculated in one or more stages; in division a 13 digit dividend can be divided by an 8 digit quotient, quotient expansion techniques permitting additional quotient positions to be developed.

Where storage permits checking is carried out of calculation and punching as a part of the integral run.

The IBM 626

This single unit machine calculates at up to 3,000 cards per hour, and verifies 4,500 cards per hour though these speeds are dependent on the amount of calculation performed, and the number of columns punched.

Up to 14 program steps may be carried out, though these can be expanded as required. Steps may be repeated or performed in any sequence, and the program can be varied according to the logical decisions produced during the calculation.

In calculations the product factor can be up to 40 digits; the multiplicand factor up to 32 digits; the divisor up to 22 digits and the dividend up to 30 digits.

The IBM 628

This is a two unit machine, consisting of a calculating unit, and a reading punch, the IBM 565, for input and output of cards. A 421 accounting machine may also form part of the machine complex.

The card handling speed of the calculator and punch is 6,000 per hour and of the calculator, accounting machine and punch 9,000 cards per hour. Representative times for the four arithmetic functions are: addition/subtraction 180 micro-seconds; multiplication 9 milliseconds (with a 16-digit product); division 12 milliseconds (with an 8-digit quotient).

The feature of the 628 is that it incorporates ferrite core storage—the first calculator to have this feature—and the read-write access time is measured in millionths of a second.

When operating with an accounting machine 421 the card reading and accumulating takes place on this machine, and the 565 acts as a summary punch. Results can thus be printed out and cards punched immediately following the conclusion of the calculation.

The De la Rue Bull Gamma 3

This is an electronic calculator which may be connected to a ULP reader/punch, a PRD reproducer or 535 tabulator; a magnetic drum will increase the machine's capacity.

The Gamma 3 operates at a speed of up to 7,200 cards per hour when operating in conjunction with the ULP or PRD and 9,000 cards per hour when operating with the 535. It is able to perform the four basic arithmetic functions in any sequence, and to undertake square roots, sines, cosines, etc.

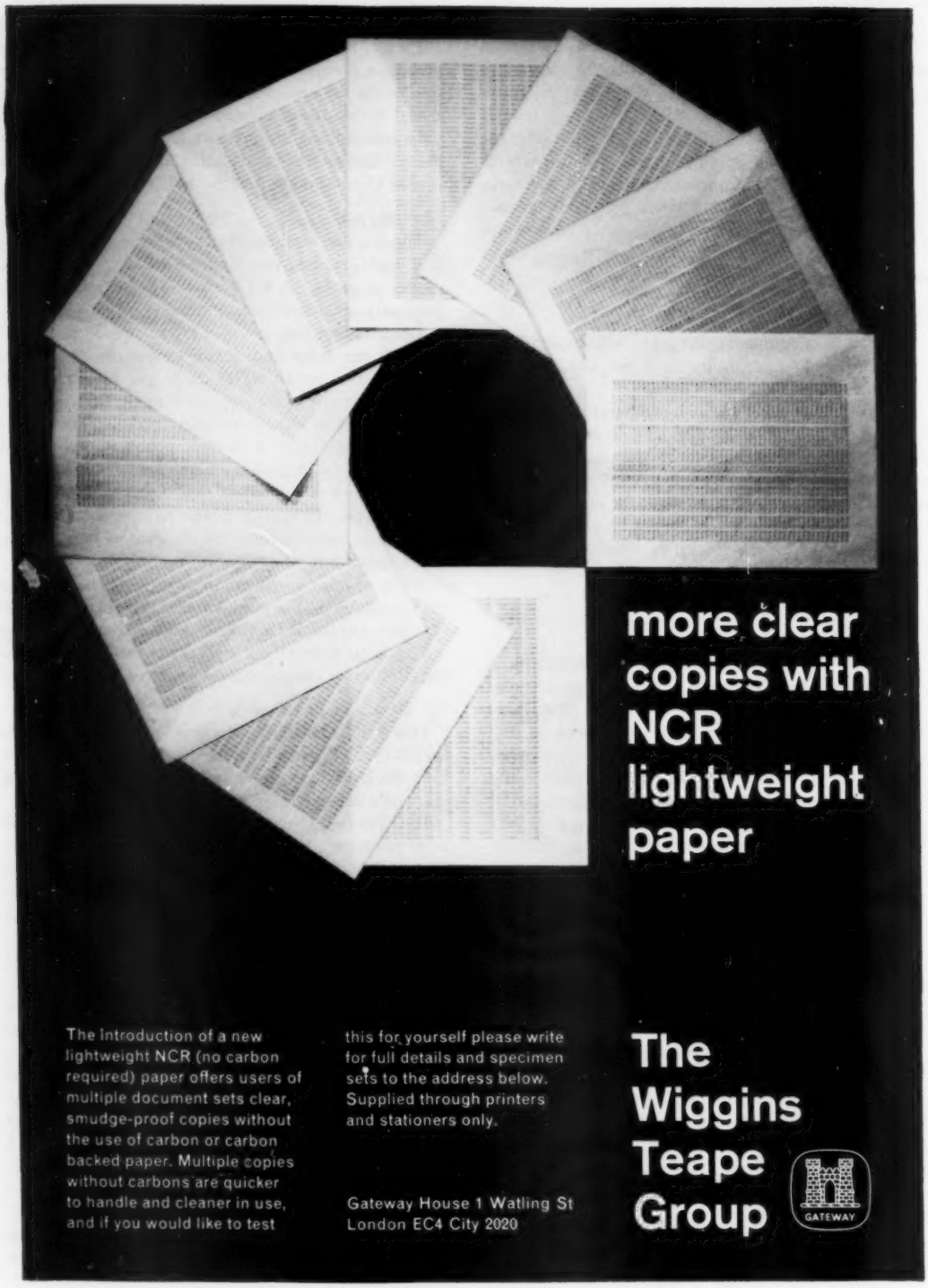
Up to 64 program steps are available on the machine, though supplementary units can be added to the number of program steps available up to 128. Thus in the standard machine 64 different basic operations can be performed on one calculation.

Data not essential to the calculation is stored in the counters of the tabulator and brought in as required.

A maximum of 23 digits is possible for a product or dividend; 12 digits for a multiplier/divisor; and 11 digits for a multiplicand/quotient.

The Gamma 3/535 connection eliminates many preliminary operations by linking the processes of calculation and printing. Either the PRD or ULP may be alternatively connected to the calculator as or when required.

The usual checking facilities are available.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WHAT'S NEW in systems, services and equipment

Data Retrieval by priority

A PERIPHERAL unit of the Honeywell computer system, the Honeywell 400 Random access storage unit is now available to users in this country.

An interesting feature of the 400 is the zoning of data stored on the disc. This enables data stored near the edge of the disc to be retrieved very quickly indeed. Other data, where access time is not so critical, can be obtained from inner zones. Thus reading or writing can be performed at 8,000 words per second on the outer zone, while the innermost zone works at 3,000 words per second. Average access time is 100 milliseconds, maximum access time is 170 milliseconds.

Data need not be read in or out via the computer, but control of the unit remains in the hands of the computer. The machine may be linked to paper tape or tabulator card punches and readers, a high-speed printer, or to a backing store of up to eight magnetic tape units.

Delivery is about 15 months.

For further details tick JO1 on the reader enquiry coupon on page 47 or write direct to:

Honeywell Controls Ltd,
Ruislip Road East,
Greenford,
Middx.

* * *

New calculator complex

A LOW cost version of the familiar IBM 604–521 Calculator-Card Read Punch, the IBM 644–564 link-up, has just been brought on to the market by IBM.

The calculator has the same general characteristics as the 604 as regards capacities, programming and testing but the machine has been slowed down to 50 cards per minute instead of the accustomed 100 cards per minute.

The machine retains its 13 digit counter and general store capacity which remains unchanged at four positions of five digits and four positions of three digits. The 13 digit counter allows the same addition, subtraction, multiplication and division capacity. The 70 step program unit is provided and the single-shot program test routine is conducted as for the 604.

The new 564 Card-Read Punch operates at half the speed of the 521 and retains the capacity of zero checking the results of a calculation at the second reader stage with the answer punched by the punch knives at the second machine cycle.

For further details tick JO2 on the reader enquiry coupon on page 47 or write to:

IBM (United Kingdom) Ltd,
Wigmore Street,
London, W1.

* * *

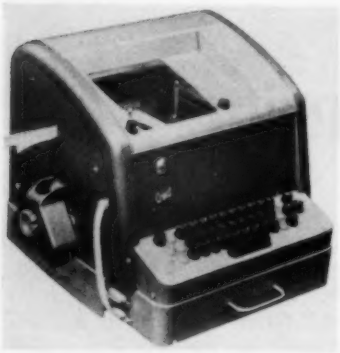
Transmission Tape punched/printed

A NEW transmitter/receiver for data transmission which will both punch and print output tape at a rate of 100 words per minute has been developed by Creed. This equipment is an automatic printing punch, the Creed 75 printing reperforator, and is designed for the automatic on-line reception of messages on five channel tape.

Printing is by special condensed characters on metal types arranged in four rings on a vertical type

cylinder. Printing is positioned between the punched sprocket feed holes, eight and a half feed hole pitches behind the corresponding code perforations. Duplicate tapes can be punched simultaneously, but only one can be printed.

A three or four row keyboard is available on the transmitter/receiver model for direct on-line manual transmission and off-line origination of code-punched printed tape. Should the printing facility not be required, the machine will serve simply as a reperforator punching five-channel tape at 100 words per minute.



Prints on punched tape

The makers consider that this equipment will be particularly suitable for teleprinter tape relay systems in airlines, etc, where transit messages need to be recorded in clear as well as in code perforations. The basic advantage of this method is that manual retransmission is avoided, and the printing will facilitate identification and eliminate distribution errors. The tape produced by this method may be handled by photoelectric readers as well as telegraph transmitters.

A tape relay monitor console, consisting of three reperforator receivers and tape winders is also available.

For further details tick JO3 on the reader enquiry coupon on page 47, or write direct to:
Creed and Co Ltd,
Telegraph House,
Croydon,
Surrey.

Linking analogue-digital computers

EQUIPMENT to enable analogue machines to be linked to a digital computer, the Packard Bell DS 110 and DS 113 computer linkage systems, are now being marketed in this country by Benson Lehner.

The equipments are standard units which are available for 'off-the-shelf' delivery and will link any analogue computer to the IBM 700–7000 series, digital computers and the Packard Bell PB 250. Bendix G15 computers have also been linked to analogue computers in the USA. Two models are available, an 11-bit and a faster 14-bit system.

For further information tick JO4 on the reader enquiry coupon on page 47 or write to:
Benson-Lehner (GB) Ltd,
West Quay Road,
Southampton.

* * *

Tape units grouped

AN improved paper tape control unit has been developed by Elliott Automation for use with the National Elliott 803.

By this method all the various paper tape input and output units are grouped together into a single paper tape station. This grouping, say the makers, gives several advantages; the tapes are more easily handled and collected for subsequent re-processing, as required; the station can be located some way from the computer, even in a separate room if that is desirable; and, most important, it will make the machine easier to program.

For further details tick JO5 on the reader enquiry coupon on page 47, or write direct to:
Elliott-Automation Ltd,
34 Portland Place,
London, W1.

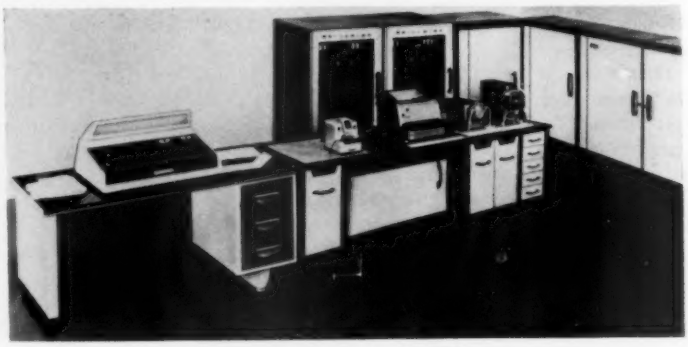
* * *

Typewriter for card punching/reading

WHEREAS typewriters have been successfully linked to punched paper tape devices for some time, Remington Rand's new Synchro typewriter range links a conventional typewriter to either a tabulator card reader or punch.

The reader consists of a 15-inch or 20-inch carriage Remington solenoid operated typewriter linked to an ICT Class 1000 reader (a modified ICT 129 punch verifier). The hopper feed arrangement on the card reader enables a pack of punched cards to be processed automatically in the reader and give a document output on the writing machine, without human intervention, at a speed of about 85 five-letter words per minute. A 14 digit totalling counter split into sterling and/or whole numbers can be fitted to the card reader as an optional extra.

The Synchro typewriter reader can be used either as a slow-speed tabulator, or as a data processing unit in its own right, to create, say, invoices. In this case quantities



Grouped for easier handling

would have to be pre-punched with other item data on to the tabulator cards. There is no ' stop code ' in the card to enable a variable to be entered via the keyboard of the typewriter. The invoice total is read out of the accumulator by a code in the next name and address card.

The Synchro typewriter punch consists of a solenoid operated typewriter linked to a modified ICT Class 029 or 030 punch. The operator can create copy on the typewriter platen and simultaneously produce punched tabulator cards, which do not need verifying. The punch is controlled by a patch board and an actuator rack on the typewriter which contains punch on and off, column check and card field skip instructions, while a program card in the punch indicates punching and non-punching fields. The operator has complete control of gang punching and error release operations from the typewriter keyboard. If she depresses two keys at once, or empties the card magazine the keyboard will lock. The typewriter can be disconnected from the punch by a panel switch on the typewriter.

For further details tick JO6 on the reader enquiry coupon on page 47, or write direct to:
Remington Rand Ltd,
Remington House,
61–65 Holborn Viaduct,
London, EC1.

* * *

For punching/printing cards on site

A PORTABLE printing/punch which enables numeric information to be punched and printed out on 80-column cards. Used in America for meter-reading and for other point-of-sales applications where a bill in the form of a punched card is used, it is nevertheless applicable to this country in a number of factory, production control and other applications.

The printing punch operates as follows: the 80-column card is placed in the machine, and the area to be punched, selected and set on the field indexing gauge. The variable data to be punched and printed are entered by positioning the appropriate keys; visual verification of the correction of digits is carried out by means of the dials on which the numbers are visible. The data is then printed and punched by the operator pressing the lock key and depressing the operating lever.

Watertight case for portable punching

There are two styles of printing/punch, the 21-1 range, and 21-2 range; these two ranges are further subdivided into models 21-1 and 21-1c, and 21-2 and 21-2c, the c-type latter models being contained in carrying cases with card storage facilities. The 21-2 models are able to punch and print up to six digits of numeric information in a fixed field. If data is recorded in more than one fixed field, control holes may be used to position the card on a locator pin, so that data may be registered in several predetermined field locations.

The 21-2 models allow punching to be carried out at a single stroke in fields up to six columns each on any location on the card. The various field locations for punching are identified by means of a printed strip on the card gauge. Data is printed across the top of the card through a ribbon. An optional feature on this equipment is a tabulating stop to locate the predetermined punching fields. The 21-2c models have two storage components holding 175 cards each.

In addition to the 21 range there is a 20-1 and 20-2 ranges which allow for data to be punched only on the cards.

The printing/punch weighs 2½ lb. and measures 8½ inches by 4¼ inches by 1½ inches thick.

For further details tick JO7 on the reader enquiry coupon on page 47, or write to:
Addressograph-Multigraph Ltd,
Maylands Avenue,
Hemel Hempstead,
Herts.

* * *

Point-of-sale card preparation

THE problem of transmitting data from the shop floor, or the point of sale to a central data processing department has led to the introduction of several cable-connected equipments. Addressograph-Multigraph have introduced an interesting variant in their Data recorder/code scanning punch system—a non-cable system.

The Data recorder is a small low cost instrument which will accept a plastic identification card which will contain both coded and interpreted data. A simple keyboard with either five or seven keys enable variables to be set up. The end product is a multi-part set which may be composed of a bill, a tabulator card and an audit copy. The tabulator card

contains all the data from the identification card and the keysettings plus a point of sale number. This is recorded in both alphanumeric script and as a pattern of code bars. Cards are sent to a data processing centre where the code bars are interpreted in the Code Scanning Punch and the tabulator card is now punched with the usual Hollerith code. The scanner can accept 27 digits of bar code for interpretation, of which either five or seven will have originated as keysettings and the rest will have come from the identification card. The machine can, in addition, punch 13 extra digits into the card. The digits may be made up of several digits from a gang-punch store and digits from a consecutive numbering device.

Provision can be made for a counter which will record amounts contained in the tabulator cards, and at the end of a machine run the total can be compared with a predetermined total.

There are several built-in safety checks: a 'length of message' feature ensures that the codes interpreted in the tabulator card conform with a fixed length of message total: moreover the positions of a matrix of punch knives is verified before the card is punched.

For further details tick JO8 on the reader enquiry coupon on page 47 or write direct to:
Addressograph-Multigraph Ltd,
Maylands Avenue,
Hemel Hempstead, Herts.

* * *

Improved punch tutor

A CONSOLE model of Saki, the Solartron automatic keyboard instructor, has just been announced by the makers.

Saki is a simulator unit which is used in the training of keypunch operators. The machine can be equipped with 12-key and full alphanumeric keyboards, according to the appropriate ICT or IBM punch which is to be used. During training exercises the operator will press the keys as for a real punching operation, and the unit will keep ahead and record her performance.

New complex for teacher

For further details tick JO9 on the reader enquiry coupon on page 47, or write direct to:
The Solartron Electronic Group,
Victoria Road,
Farnborough,
Hants.

We hear . . . .

HONEYWELL Controls Ltd are to market a device developed by their American associates, Minneapolis-Honeywell, which will allow programs written for other computers to be run without modification on Honeywell 800 computers. In the same way programs developed for the 800 can be run on other computers, provided in both cases that the peripheral equipment is the same for the original system as for the new applications.

The device, a simulator unit, has been added to the Honeywell 800 to make it compatible with programs written for the IBM 650 and for Univac computers. (In the August issue of ADP reference was made to 'translators' which enabled Honeywell 800 and 400 to work with tape written by IBM machines, and to write tapes acceptable to IBM equipment.)

* * *

SOLARTRON Electronics have a new digital computer known as the Minimal. This is a small solid state device suitable for special purpose scientific and technical calculations, though the makers consider that it could be used for business applications also. No more details are yet available.

* * *

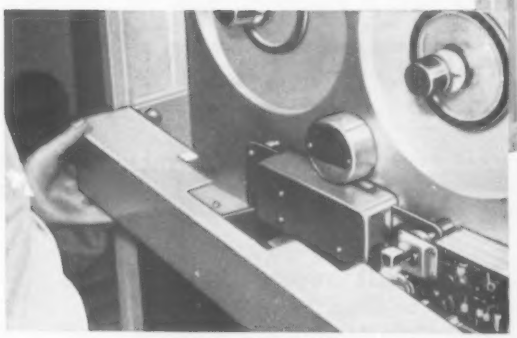
BURROUGHS Machines Ltd are marketing a low-cost 12-key adding subtracting machine. This machine is designed to record amounts in sterling and by using a control key adding or subtracting of whole numbers only becomes possible. A paper feed device spaces the tape to the tear off position automatically after each total; control keys minimise hand travel and a large index bar helps to make the indexing of ciphers easy.

Economic adder

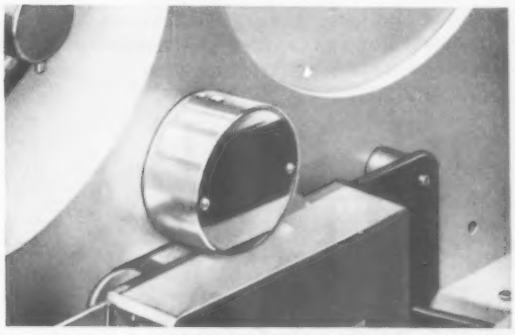
* * *

Ultra Electronics Ltd. are to introduce a new numerical keyboard (UE 874) and numerical keyboard with selector (UF 874). The UE 874 can be used for remote control of a solenoid operated Olivetti Elettrosumma 22 or to prepare numerical data on paper tape. The UE 871 has a 10-way selector panel to allow up to 10 Elettrosumma machines to be selectively fed from the keyboard.

2 more points prove **Honeywell leaders in EDP**



Vacuum capstans *not* pinch rollers to safeguard tape



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AND ORTHOTRONIC CONTROL

With this other exclusive Honeywell feature, uninterrupted accuracy is assured throughout processing. Lost or damaged data are recreated instantaneously without human aid, without reprocessing. Errors can be detected and corrected in 1/20th of a second.

These are just two of the reasons why Honeywell EDP systems are acknowledged leaders of 'the new generation'. For details of the others—the true parallel processing, the simplified programming language, the speed and accuracy—write to Electronic Data Processing Division, Honeywell Controls Limited, Greenford, Middlesex. Waxlow 2333.

Honeywell

Electronic Data Processing

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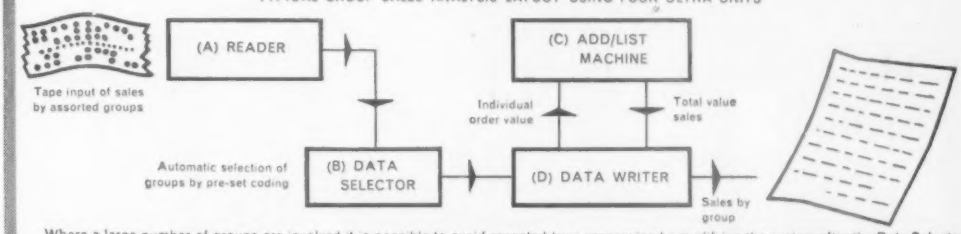
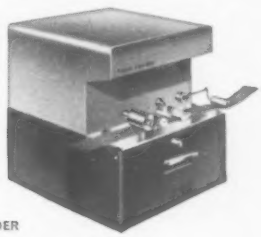


Where a large number of groups are involved it is possible to avoid repeated tape processing by modifying the system after the Data Selector.



(A) READER

(C) ADD/LIST MACHINE

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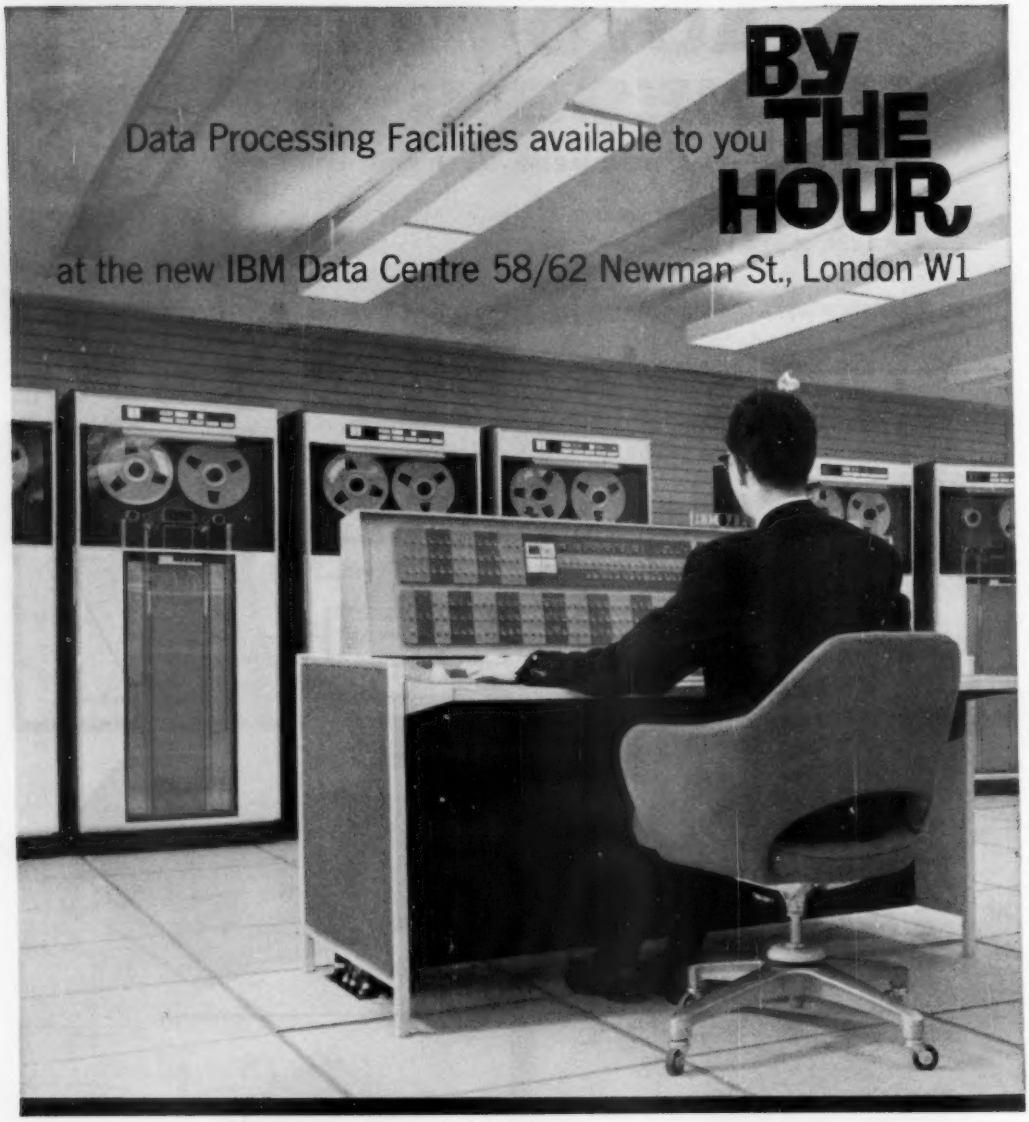

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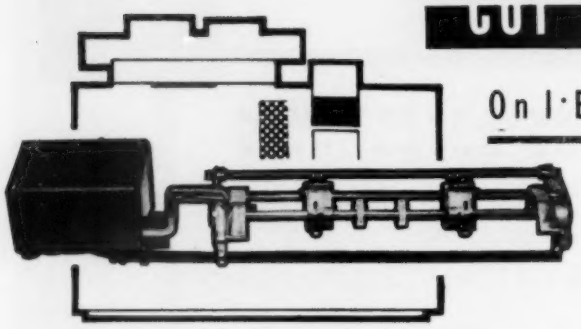

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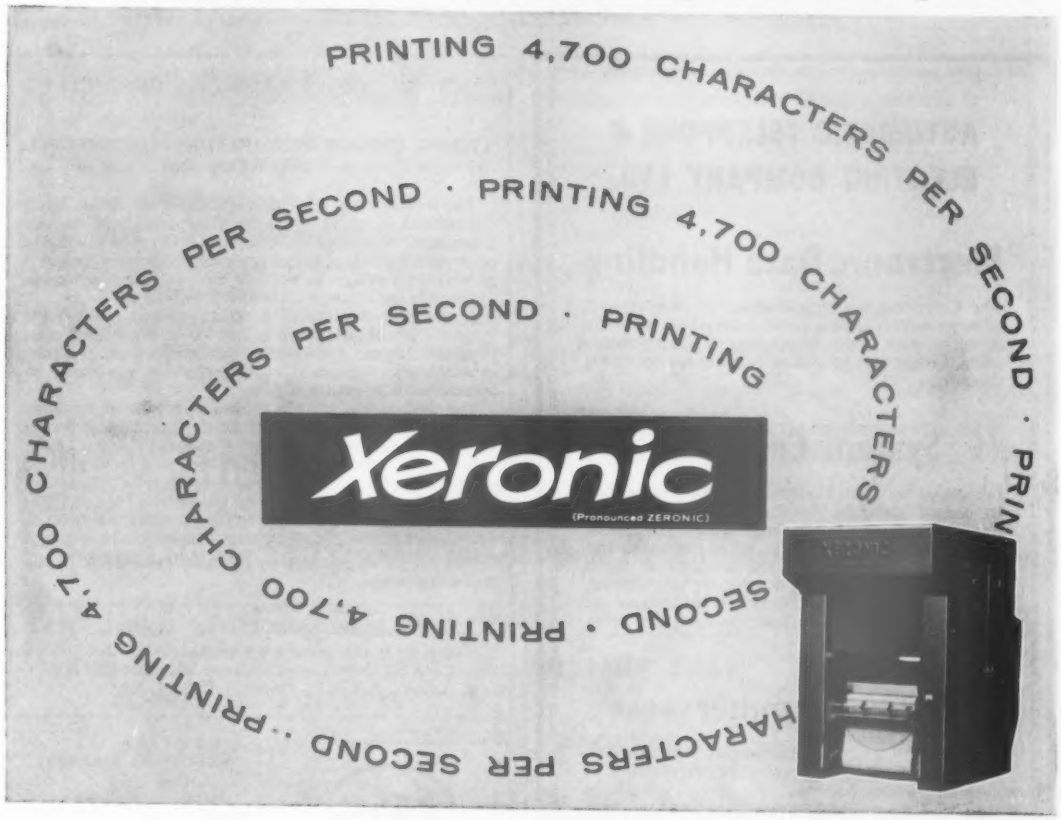

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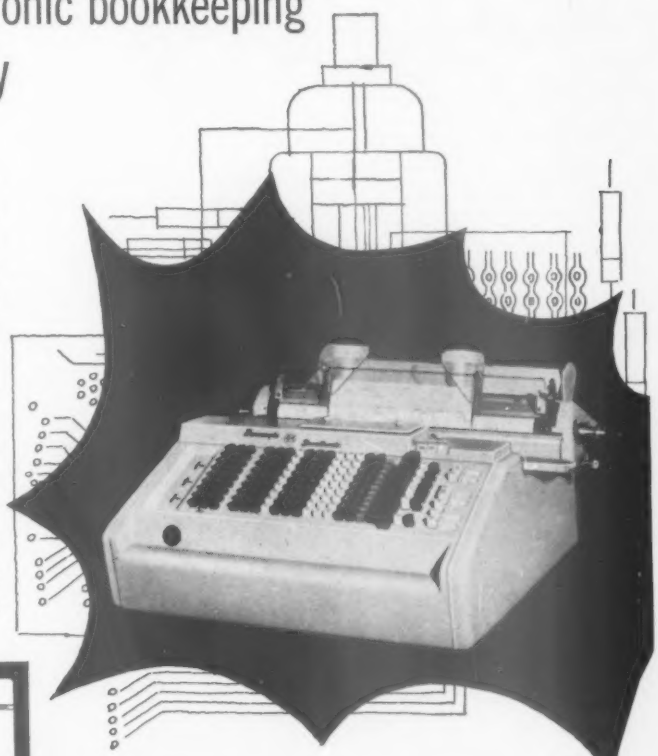

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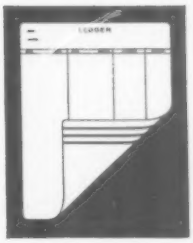

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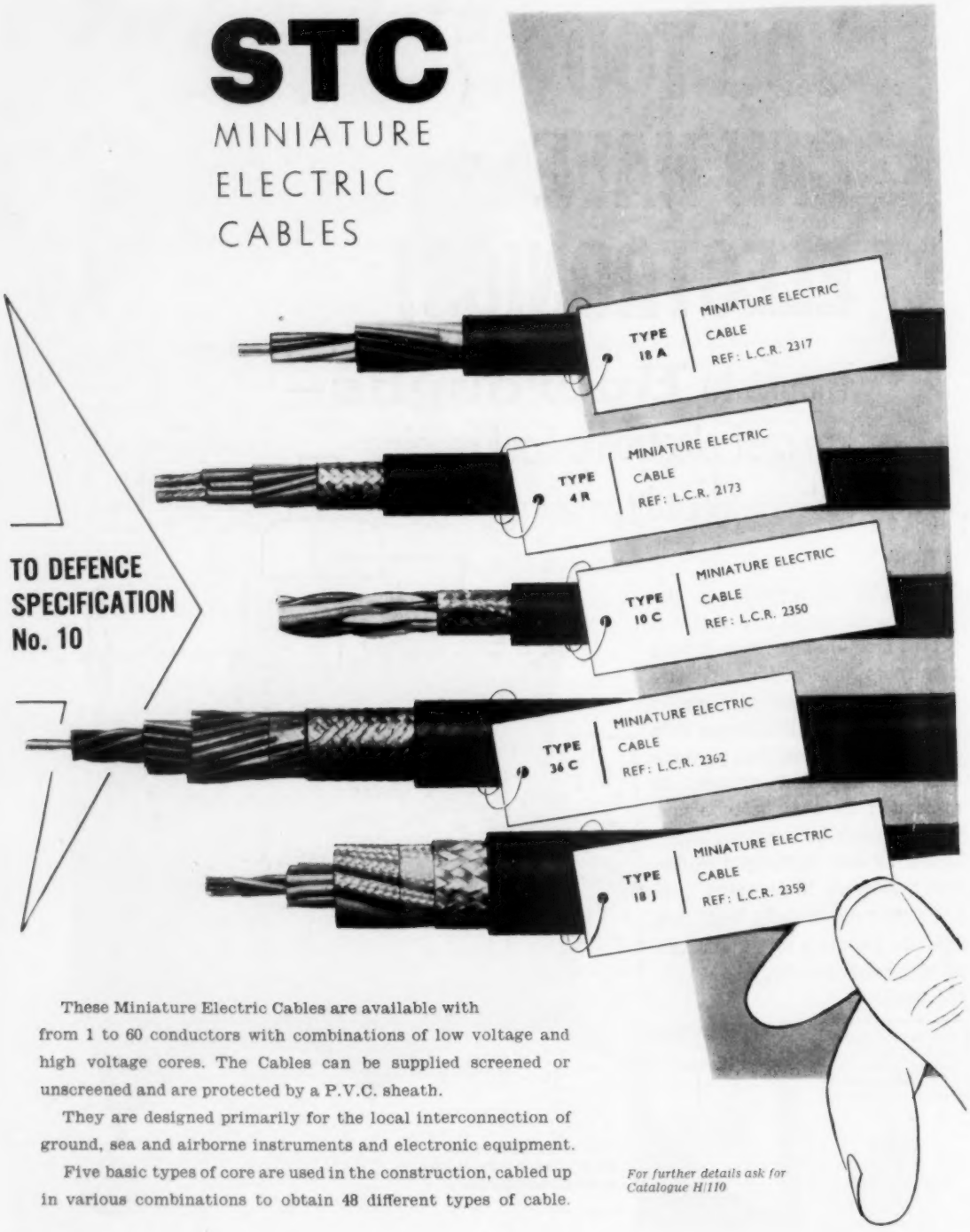

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